ELECTRONICS & TELECOMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

Meeting of **BOS** of Electronics & Telecommunication Engineering Branch, BVM (Autonomous), was held at **10:30 AM** on Date: **08-09-2016** to discuss following agenda items :

Agenda of the Meeting

ET1617.1.1	Renaming of Electronics and Telecommunication (ET) Engineering Programme (Branch) to Electronics and Communication (EC) Engineering programme (Branch) as per EOA of AICTE w.e.f 2016-17. (Annexture –I.)
ET1617.1. 2	To discuss & approve amendment in teaching structure of few first level Autonomy subjects as per Annexture –II.
ET1617.1. 3	Vision, Mission, Programme Educational Objectives (PEOs), Programme Specific Outcomes (PSOs), Programme Outcomes (POs).
ET1617.1. 4	To discuss, suggest & approve amendment in syllabi of second level autonomy subjects offered by BOS with CO – PO (PSO) Mapping (Annexture – III).
ET1617.1. 5	To revise teaching scheme & structure of Third level (Annexture – IV) & Final level (Annexture – V) of the UG (Electronics & TeleCommunication) programme.
ET1617.1 .6	To suggest & approve Equivalence of Second level Gujarat technological University (GTU) Subjects and BVM Autonomy Subjects (Annexture – VI).
ET1617.1 .7	Revised teaching scheme for two second level Autonomy subjects (1) ET-205 Simulation & Design Tools (2) ET – 210 Mini Project. (Annexure – VII)

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Board of Studies Meeting

1. Following BoS members were present in the meeting. (As per **Annexure –VIII**)

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. M.B. Shah	Asso. Professor,ET,BVM	Chairman
2	Prof. Kaushal Patel	Asst.Professor,ET,BVM	Secretary
3	Dr. B.C.Goradia	Asso.Professor,ET,BVM	Faculty Member
4	Prof.Arjan Bambhaniya	Asst. Professor,ET,BVM	Faculty Member
5	Prof. P.S.Bhakhar	Asst.Professor,ET,BVM	Faculty Member
6	Prof.Darshan Dalwadi	Asso.Professor,ET,BVM	Faculty Member
7	Prof.Hiren Patel	Asst.Professor,ET,BVM	Faculty Member
8	Prof.Robinson Paul	Asst. Professor,ET,BVM	Faculty Member
9	Prof.Ghanshyam Rathod	Asst. Professor,ET,BVM	Faculty Member
10	Prof.Ripal Patel	Asst. Professor, ET, BVM	Faculty Member
11	Prof.Palak Patel	Asst. Professor, ET, BVM	Faculty Member
12	Dr. S.R. Unadkat	Asst. Professor, ET, BVM	Faculty Member
13	Prof.Anish Vahora	Asst. Professor, ET, BVM	Faculty Member
14	Prof. R.C.Rana	Asst. Professor, ET, BVM	Faculty Member
15	Prof.Amit Choksi	Asst. Professor, ET, BVM	Faculty Member
16	Prof.Ronak Vashi	Asst. Professor, ET, BVM	Faculty Member
17	Prof.Mayur Sevak	Asst. Professor, ET, BVM	Faculty Member
18.	Dr. R.A Thakkar	Professor,VGEC,Ahmedbad	V.C Nominee
19.	Dr. N.J Kothari	Head & Professor ,DDU,Nadiad	Member – Nominated by Academic Council
20.	Dr.Bhaskar Thakkar	Head ,EC Department, GCET	Member – Nominated by Academic Council
21.	Mr. Nikunj N Soni	SDE (EWSD SWITCH) BSNL ,Ahmedabad	Representative from industry related to

			placement
22.	Mr. Krunal Patel	Project manager ,SLS,Anand	Representative from industry related to placement

2. Following Members were unable to attend the meeting.

Sr. No.	Name of Member	Designation	Role in BoS
1.	Miss Pooja Y. Shah	Meritorious Alumni	Nominated by Principal
2.	Dr. Dhaval Patel	Senior Asst. Professor, IET – Ahmedabad University	Member – Nominated by Academic Council

AGENDA	DISCRIPTION
ET1617.1.1	**Renaming of Electronics and Telecommunication (ET) Programme to Electronics and Communication (EC) programme (Branch) as per EOA of AICTE w.e.f 2016-17.**

Following discussion & Approval were made anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Discussion & Approval
1.1	Dr. N.J Kothari , Dr.Bhaskar Thakkar & other Present BOS members.	ET BoS	As per latest EOA 2016-17, F.No. Central/1-2813057258/2016/EOA from AICTE, ET BOS would like to rename Electronics and Telecommunication (ET) Engineering programme to Electronics and Communication (EC) Engineering programme w.e.f 2016-2017 Academic year .

From EOA (Extension of Approval) of AICTE as per Annexure-I attached.

AGENDA	DISCRIPTION
ET1617.1.2	**To discuss & approve amendment in teaching structure of few first level Autonomy subjects as per Annexture -II**

Following discussion & Approval were made anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

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Sr. No.	Expert Name	BoS	Discussion & Approval
2.1	Dr. N.J Kothari , Dr.Bhaskar Thakkar ,Dr.M.B Shah	ET BoS	**Amendment in teaching structure of few first year Autonomy subjects as per Annexture –II approved.**

Teaching Structure (Proposed & Approved) for **First Year** of B.TECH Electronics and Communication BVM (Autonomous) w.e.f Academic Year: 2017-18

ANNEXTURE – II

Sr. No	Code	Course	Teaching Scheme					Evaluation Scheme				
		Semester - I	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL MARKS**
1	CC101	Calculus	3	2	0	5	5	30	70	20	30	150
2	CC111	Basic Civil Engineering	3	0	2	5	5	30	70	20	30	150
3	CC121	Computer Programming	4	0	2	6	6	30	70	20	30	150
4	CC141	Fundamentals of Electronics	4	0	2	6	6	30	70	20	30	150
5	CC142	Electronics Workshop	0	0	2	2	2	0	0	20	30	50
6	CC152	Basic Mechanical Engineering	3	0	2	5	5	30	70	20	30	150
		Total	**17**	**2**	**10**	**29**	**29**	**150**	**350**	**120**	**180**	**800**
		Semester - II	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL MARKS**
1	CC102	Vector Calculus and Linear Algebra	3	2	0	5	5	30	70	20	30	150
2	CC122	Computer Workshop	0	0	2	2	2	0	0	20	30	50
3	CC131	Basic Electrical Technology	3	0	2	5	5	30	70	20	30	150
4	CC143	Engineering Physics	3	0	2	5	5	30	70	20	30	150
5	CC151	Engineering Graphics	2	0	4	6	6	30	70	20	30	150
6	CC171	Communication Skills	2	0	2	4	4	30	70	20	30	150
7	CC174	Value Education, Human Rights & Legislative Procedures	2	0	0	2	2	30	70	-	-	100
		Total	**15**	**2**	**12**	**29**	**29**	**180**	**420**	**120**	**180**	**900**

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AGENDA	DISCRIPTION
ET1617.1.3	**Vision, Mission,Programme Educational Objectives (PEOs), Programme Specific Outcomes(PSOs), Programme Outcomes (POs).**

Sr. No.	Expert Name	BoS	Discussion & Approval
3.1	Dr. N.J Kothari ,Dr. Bhargav C. Goradiya	ET BoS	In Mission of the department Change 1st statement as "**Adapt** curriculum based on need of industry" instead of "**Re-engineer** curriculum based on need of industry "
3.2	Dr. N.J Kothari ,Dr. Bhargav C. Goradiya	ET BoS	In Mission of the department Change 2nd statement as "**Strengthen** teaching - learning processes instead of **Reform** teaching - learning processes"

[A] Vision of the Department

Vision of the department is in line with the vision of the BVM engineering college: Produce globally employable innovative electronics and communication engineers with core values.

[B] Mission of the Department

The mission of the Department of Electronics & communication engineering in conformity with the mission of the BVM Engineering College:

1. **Adapt** curriculum based on need of the industry.
2. **Strengthen** teaching - learning processes and systems to meet global standards.
3. Promote innovative practices to maintain pace with the Electronic Communication Technology.
4. Develop faculty and staff members to meet the challenges of Electronics and Communication field.
5. Inculcate core values and ethics.

[C] Programme Educational Objectives

I. Provide innovative communication engineering solutions.
II. Develop Hardware as well as software based applications for the electronics.
III. Adapt the state-of-the-art technologies in emerging Communication applications.

[D] Programme Specific Outcomes

1. Demonstrate the skills to analyze analog and digital electronics systems.

2. Use EDA tools and software to design electronics circuits and systems.
3. Demonstrate the skills to design embedded and communication systems.

[E] Programme Outcomes (POs)

a. Engineering knowledge
b. Problem analysis
c. Design/development of solution
d. Conduct investigation of complex problems
e. Modern tools usage
f. The engineer and society
g. Environment and sustainability
h. Ethics
i. Individual and team work
j. Communication
k. Project management and finance
l. Lifelong learning

Matrix mapping of Mission statement and PEOs

PEOs	Correlated with mission statements				
I	1	3	5	-	-
II	1	4	5	-	-
III	1	2	3	4	5

AGENDA	DISCRIPTION
ET1617.1.4	To discuss, suggest & approve amendment in syllabi of second level autonomy subjects offered by BOS with CO – PO (PSO) Mapping (Revised Annexure – III).

Sr. No.	Expert Name	BoS	Discussion ,Suggestion & Approval
4.1	Dr.R.A Thakkar, Dr. N.J Kothari & other BOS members.	ET BoS	Make simple table of Constituent Course outcomes (COs) in Assessment Tools in syllabi ,list out 5-6 single sentence Course Outcomes.

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Annexure –III

ET201: Electronic Devices and Circuits

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2nd Year, B. Tech. (*Electronics and Telecommunication*)

Course Objective:

To familiarize students with small signal low and high frequency analysis on BJT circuits, various feedback circuits & oscillators,Power amplifiers,op-amp and its applications ,various specialized IC for regulated power supply & timer (555).

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

Unit No.	Topics	Teaching Hours
1.	**Review of Diode , BJT , JFET, MOSFET:** Introduction, Construction, Operation, Characteristics Operating Point, Fixed-Bias Circuit, Emitter-Stabilized Bias Circuit, Voltage-Divider Bias, DC Bias with Voltage Feedback of BJT , JFET, MOSFET	08

Unit No.	Topics	Teaching Hours
2.	**Small Signal Low Frequency Analysis And Design:** Introduction, Amplification in the AC Domain, BJT Transistor Modeling, The Important Parameters: Z_i, Z_o, A_v, A_i ,The r_e Transistor Model, The Hybrid Equivalent Model, Graphical Determination of the *h*-parameters, Common-Emitter Fixed-Bias Configuration, Voltage-Divider Bias, CE-Emitter Bias configuration, Emitter-Follower Configuration, Common-Base Configuration.	10
3.	**The Transistor At High Frequencies:** Hybrid–pi CE transistor model, Hybrid–pi conductance, Hybrid–pi capacitances, Validity of hybrid–pi model, Variation of hybrid–pi parameters, CE short-circuit current gain, Current gain with resistive load, Single-stage CE transistor amplifier response, Gain-bandwidth product, Emitter follower at high frequencies	08
4.	**Audio Frequency Power Amplifier:** Introduction—Definitions and Amplifier Types, Series-Fed Class An Amplifier, Transformer-Coupled Class-A Amplifier, Class-B Amplifier Operation and Circuits, Amplifier Distortion, Class-C and Class-D Amplifiers.	06
5.	**Feedback And Oscillator Circuit:** Feedback Concepts, Feedback Connection Types, Feedback Amplifier—Phase and Frequency Considerations, Oscillator Operation, Phase-Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuit, Crystal Oscillator, UJT Oscillator.	08
6.	**Operational Amplifiers & Application:** Introduction, Block Diagram representation of a typical op-amp, Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal Drift, Effect of variation in power supply voltages on offset voltage, Change in input offset voltage and input offset current with time, Other temperature and supply voltage sensitive parameters, Noise, Application: amplifiers , comparators, converters.	10

Unit No.	Topics	Teaching Hours
7.	**Specialized IC:** (A)555 Timer and its applications : Block diagram, Monostable and Astable multivibrator, Applications as Frequency divider, Square wave generator (B)Design of Power Supply :Simple op-amp voltage regulator, Three terminal voltage regulators, Fixed and adjustable voltage regulators (78XX, LM317), Heat sink, Dual power supply (LM320, LM317), Basic switching regulator and its characteristic	10
	Total Hours	60

List of References:

1. R.L. Boylestad& Louis Nashelsky, "*Electronic Devices & Circuits theory*", 10th Edition Pearson Education, 2009.
2. MillmanHalkias, "*Integrated Electronics*", McGraw hill, 2nd Edition, 2011.
3. Ramakant A. Gaikwad, "*Opamps and Linear Integrated Circuits*", PHI, 4th Edition, 2009.
4. David Bell, "*Electronic devices & circuits*", Oxford Publications, 5th Edition, 2008.

Course Outcomes (COs):
By learning this course students will be able to …

1. Recollect basic knowledge of Diode, BJT, FET working operation & conditions.
2. Understand & Analyze BJT circuits at low and high-frequency.
3. Categorize various audio frequency power amplifier circuits and their comparison.
4. Design Simple oscillator circuits.
5. Study and measure various op-amp parameters.
6. Test Specialized IC for power supply regulator & Timer and design their applications.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET201.1	3	2	2	1	1	1	-	-	1	-	-	3	3	1	1
ET201.2	3	2	2	2	1	2	-	--	2	2	-	3	2	1	1
ET201.3	3	2	1	1	1	2	-	-	2	2	1	3	2	1	1
ET201.4	3	3	2	1	2	3	-	-	2	2	-	3	2	1	1
ET201.5	3	2	2	1	1	3	-	-	2	2	2	3	2	1	1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET201.6	3	2	2	1	2	3	-	-	3	2	2	3	2	1	2
Average	3	2.16	1.83	1.16	1.33	2.33	-	-	2.0	1.66	0.83	3	2.16	1	1.16

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Analog Trainer kits, Bread board, Active & Passive Components,ICs, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	ET 201.1	**Exam,Assignments, Presentation,Experiments**
2.	ET 201.2	**Exam,Assignments, Presentation,Experiments**
3.	ET 201.3	**Exam,Assignments, Presentation,Experiments**
4.	ET 201.4	**Exam,Assignments, Presentation,Experiments**
5.	ET 201.5	**Exam,Assignment,Presentation,Experiments**
6.	ET 201.6	**Exam,Assignments, Presentation,Experiments**

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ET202: Network Analysis and Synthesis

CREDITS - 6 ($L=L_4$, $T=T_0$, $P=P_2$)

2nd Year, B. Tech. (*Electronics and Telecommunication*)

Course Objective:

Students of EC Engineering able to understand concepts and principles of passive circuit analysis and synthesis by applying various circuit laws and theorems, to understand the concepts of advance courses and to develop skills which are necessary in Electronics field.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Sr. No.	Topics	Teaching Hrs.
1.	**Review Topics:** Introduction, basic terminology and definitions related to networks, classification of networks, Kirchhoff's laws.	03
2.	**Analysis of Resistive Circuits:** Mesh Analysis of Circuits with Dependent and Independent Sources, Concept of Super mesh, Nodal Analysis of Circuits Containing Dependent and Independent Sources,Concept of Super node, Source Transformation technique, Duality.	05
3.	**Magnetic Circuits & Resonance:** Mutual inductance, Dot convention for coupled circuits, Series Resonance, Parallel resonance, Quality factor in resonance, Relation between quality factor and bandwidth.	03
4.	**Network Theorems For DC &AC Circuits:** Superposition Theorem, The venin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Substitution Theorem, Millman's Theorem, Application of above theorems in	06

	presence of dependent sources.	
5.	**Network Topology:** Concept of Network Graph and Definitions, The Cut-set Matrix, The Tie-set atria, Kirchhoff's Laws in Fundamental Cut-set and Tie-set Matrix.	04
6.	**Initial Conditions:** Initial conditions in elements, Procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.	08
7.	**Time Domain Analysis& Transient Response of Linear Circuits:** Mathematical background, First order differential equations, Solution of Non-homogeneous equation using integrating factor, Time-constants, Second order equation, Solution of non-homogeneous differential equation, Examples.	06
8.	**Frequency Domain Analysis & Transient Response Of Linear Circuits:** Laplace transformation, Inverse Laplace transformation, Partial fraction expansion, Heaviside's Expansion theorem, The initial and final value theorem Sinusoidal transient analysis using Laplace transform methods, complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations.	06
9.	**Network Functions:** Poles and Zeros of the networks function, Restriction on Pole and Zero locations for driving point and transfer function.	03
10.	**Two –Port Networks:** Two port Impedance parameters, Two port Admittance Parameters, Two port Hybrid parameters, and Two port Transmission parameters, Symmetry and Reciprocity of all parameters, Inter-relationship between all these parameters.	06
11.	**Network Synthesis :** Basic synthesis procedure, Methods of synthesis, Driving point synthesis of one-port networks, synthesis of RLC driving point functions	05
	Total Hrs.	**55**

List of References:

5. Van Valkenburg ,"*Network analysis*", PHI,3rd Edition,2007.
6. Franklin S. Kuo, "*Network Analysis & Synthesis*" ,Wiley India,2nd Edition,2010.
7. John O' Malley, "*Basic Circuit Analysis*",Schaum'series, Mcgraw-Hill ,2/E,2011.

8. De Carlo/Lin.,"*Linear Circuits Analysis*", Oxford University Press.,2nd Edition,2003.
9. A. Chakrabarti,"*Circuit Theory: Network analysis and Synthesis*",Dhanpat Rai& Co. Pvt.Ltd,6th Edition,2014.
10. U. A. Patel, "*Network Analysis*", Mahajan Publication, 3rd Edition, 2007.

Course Outcomes (COs):
By learning this course students will be able to …

1. apply various circuit laws and can perform its analysis.
2. analyze behavior of passive circuits such as RC, RL and RLC.
3. apply Laplace Transform for circuit analysis.
4. obtain transfer function of a network.
5. analyze circuit considering initial conditions.
6. calculate two port parameters ,find tie set & cutset schedules for two port network topologies.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET202.1	3	3	3	3	1	1	-	-	2	-	2	3	3	1	2
ET202.2	3	3	3	2	1	1	-	-	2	-	2	1	3	1	2
ET202.3	3	3	3	3	1	2	-	-	1	-	2	3	3	2	2
ET202.4	3	3	2	3	1	2	-	-	1	-	1	3	3	2	2
ET202.5	3	3	3	3	1	3	-	-	1	-	1	3	3	3	1
ET202.6	3	3	3	3	1	3	-	-	1	-	1	3	3	1	1
Average	3	3	3	2.83	1	2	0	0	1.33	0	1.5	2.66	3	1.66	1.66

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Analog Trainer kits, Bread board, Active & Passive Components, ICs, Function Generator, Oscilloscope, Digital Multimeter, Power Supply, etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	ET 202.1	**Exam,Assignments, Presentation,Experiments**
2.	ET 202.2	**Exam,Assignments, Presentation,Experiments**
3.	ET 202.3	**Exam,Assignments, Presentation,Experiments**
4.	ET 202.4	**Exam,Assignments, Presentation,Experiments**
5.	ET 202.5	**Exam,Assignments, Presentation,Experiments**
6.	ET 202.6	**Exam,Assignments, Presentation,Experiments**

ET 203: DIGITAL CIRCUIT DESIGN

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2nd Year, B.TECH (Electronics & TeleCommunication)

Course Objective :

The students need to learn basic concepts of digital circuits which leads of complex digital systems like microprocessors & needs to know combinational and sequential circuits using digital logic fundamentals.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Power point Presentations	Performance/Quiz/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Number System and Binary Codes:** Binary Number System, Binary-to-decimal Conversion, Decimal-to-Binary Conversion, Octal Number, Hexadecimal Numbers, Classification of Binary Codes,8421 BCD Codes,Excess-3 Code, Gray Code, Signed and Unsigned Binary Number,1's and 2's Complements.	06
2.	**Digital Logic Gates And Families:** The Basic Gates-AND, OR,NOT, Universal Logic Gates-NAND,NOR Exclusive-OR and Exclusive-NOR, Positive and Negative Logic, Transistor Logic, Integrated Injection Logic, Emitter Couple Logic, MOS Logic, COMS Logic.	07
3.	**Boolean Algebra and Mapping Methods:** Boolean Laws, Duality, SOP and POS Form, Reducing Boolean Expression Converting AND/OR/INVERT to NAND/NOR Logic, Karnaugh Map, Don'tcare Condition, Simplification of Boolean Expression using Karnaugh Map.	08
4.	**Arithmetic and Data Processing Circuits:** Half and Full Adder, half and Full Subtractor, 4-Bit Binary Parallel adder, Binary Subtractor, BCD and EX-3 adder and Subtractor, CODE Conversion, Parity Generator/Checker, Magnitude Comparator, Decoder/Encoder,Application of Decoder/Encoder, Multiplexer/De- Multiplexer , Application of Multiplexer/De-Multiplexer.	08
5.	**Programmable Logic Device:** Introduction to Programmable Logic Device, Read Only Memory, Programmable Logic Array,Programmable Array Logic.	04

Unit No.	Topics	Teaching Hours
6.	**Flip Flops and Registers:** Latches and Flip-Flop,SR Flip-Flop, Gated Flip-Fledge-Triggered SR Flip-Flo, Edge-Triggered D Flip-Flop,Edge-Triggered T Flip-Flop, Flip-Flop Excitation Table, Conversion of Flip-Flop, Introduction to Shift Registers, Buffer Register, SISO,SIPO,PISO,PIPO Shift Register, Universal Sift Register.	07
7.	**Counter and Introduction of State Machines:** Asynchronous and Synchronous Counter, Design of Asynchronous Counter,Effect of Propagation Delay in Ripple Counter, Design of Synchronous Counter, Ring Counter and Twisted Ring Counter, Introduction of Finite State Model.	06
8.	**State Machines:** Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, Finite state machine implementation, Sequence detector.	06
9.	**Introduction to HDL:** Library, Entity, Architecture, Modeling styles, Data objects, Concurrent and sequential statements, Design examples, using VHDL for basic combinational and sequential circuits.	04
	Total Hrs.	**55**

List of References :

1. Stephen Brown, "*Fundamentals of digital logic design with VHDL*",McGraw-Hill,1/E,2002.
2. R.P. Jain, "*Modern digital electronics*", McGraw-Hill, 3rd edition, 2007.
3. A. Anand Kumar, "*Fundamentals of digital circuits*", PHI publication, 1st edition, 2001.
4. Wakerly Pearon, "*Digital Design: Principles and Practices*", PHI, 3rd edition, 2004.
5. Bhaskar, "*VHDL Primer*", PHI Publication, 3rd Edition, 2009.

6. Mark Bach, "*Complete Digital Design*", McGraw- Hill, 2005.
7. Volnei Pedroni, "*Digital Electronics and Design with VHDL*", Elsevier science, 2008.

Course Outcomes (COs) :

At the end of this course students will be able to …

1. Understand the structure of various number systems and its application in Electronics.
2. Understand the fundamental concepts and techniques used in digital circuit design.
3. Understand, analyze and design simple combinational and sequential circuits.
4. Identify basic requirements to design application and propose a cost effective solution.
5. Develop skill to build and troubleshoot digital circuits.
6. Use the language (VHDL) to design digital circuits.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ET203.1	3	3	3	2	-	3	-	-	-	2	2	1	3	2	3
ET203.2	3	3	3	3	-	3	-	-	-	2	2	-	3	2	3
ET203.*3*	3	3	3	3	2	3	-	-	2	2	2	-	3	2	3
ET203.4	3	3	3	3	2	3	-	-	2	3	2	-	3	2	3
ET203.*5*	3	3	3	3	2	3	-	-	2	2	2	2	3	2	3
ET203.*6*	3	3	3	3	3	3	-	-	-	1	2	1	3	2	3
Average	3	3	3	3	1.5	3	-	-	1	2	2	0.67	3	2	3

Delivery Methods :

1. Lectures through Blackboard, power-point slides, videos, animations, pictures, graphics etc.

2. Laboratory: Performance of Experiments Using Digital Trainer kits, ICs, Bread boards and Software (XILLINX), Power Supply etc.

Consumable Items: Various logic ICs for logic gates, flip-flops, latch, decoders, encoders, multiplexers, demultiplexer, etc., hook-up wires, Soldering iron, desoldering pump, Electronics Toolkit, duplexer, etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	ET203.1	**Exam,Assignments, Presentation,Experiments**
2.	ET203.2	**Exam,Assignments,Presentation,Experiments**
3.	ET203.*3*	**Exam,Assignments, Presentation,Experiments**

4.	ET203.4	**Exam,Assignments, Presentation,Experiments**
5.	ET203.*5*	**Exam,Assignments, Presentation,Experiments**
6.	ET203.*6*	**Exam,Assignments,Presentation,Experiments**

ET 204: OBJECT ORIENTED PROGRAMMING

CREDITS - 5 (L=L_3, T=T_0,P=P_2)

2^{nd} Year, B. Tech. (*Electronics and Telecommunication*)

Course Objective:
To Learn basics concepts & constructs of C++ programming including Basics of C++ environment, Data representation,
structures, Functions, Arrays, Pointers, Strings and Classes.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Practical Performance/ Quiz

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction to C++:** Introduction OOP, Procedural Vs. Object Oriented Programming, Basic concept of OOP, Principles of OOP, Benefits and applications of OOP, Programming in C++.	04
2..	**Data types, Operators and Control Structures:** Data Types, Keyword, Tokens, identifiers, variables, constants, enum, operators, typecasting, control structures.	05

Unit No.	Topics	Teaching Hours
3.	**C++ Functions:** Function Prototyping, Call by value and reference, Return by reference, Inline function and macro function, Default Arguments, Function Overloading.	05
4.	**Class and Objects:** Structure vs Class, Member function Declaration, Access Specifier for member function, Static data Member and Member Function, Friend Function, Object as Argument.	07
5.	**Constructor and Destructor:** Constructor, Types of Constructor, Destructor.	04
6.	**Operator Overloading and Type Conversion:** Unary and Binary Operator Overloading, Types of Type Conversion.	04
7.	**Inheritance:** Inheritance, Types of Inheritance, Virtual Base Classes, Abstract Class, Constructor in Derived Class	04
8.	**Virtual Function and Polymorphism:** Polymorphism, Types of Polymorphism, this Pointer, Virtual Function, Pure Virtual Function	04
9.	**I/O Functions & File Management:** Formatted and Unformatted I/O Operations, Manipulators, Classes for File Operations, Basic File Operations, File Functions, Error Handling Operations, Command Line Arguments.	04
10.	**Template and Exception Handling:** Template, Types of Template, Multiple Parameter in Class template and function template, Overloading of template function, Try, Catch and Throw, Multiple Catch, Rethrow Exception.	04
	Total Hours.	45

List of References:

1. Bhushan Trivedi, *"Programming with ANSI C++"*, Oxford University Press, 2nd edition, 2013.

2. E Balagurusamy, *"Object Oriented Programming with C++"*, McGraw- Hill, 6th edition, 2013.
3. Herbert Schlitdt, *"C++ the Compete Reference"*, McGraw- Hill, 5th edition, 2014.
4. Ashok Kamthane, *"Object Oriented Programming with ANSI and Turbo C++"*, Pearson Education, 1st Edition, 2011.

Course Outcomes (COs):

By learning this course students will be able to …

1. Remember the basic programming concepts and the necessary constructs of C++ programming.
2. Understand algorithmic thinking and problem solving techniques.
3. Describe Conceps like object and class, Encapsulation, inheritance, polymorphism, template and exception handling for real life problems.
4. Apply advance features to make programs which supports reusability and sophistication.
5. Test standard template library for faster development.
6. Resolve C++ program using variables,operators,control structures,functions, objects

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET204.1	1	2	2	1	2	-	-	1	1	-	-	2	-	1	3
ET204.2	2	3	3	2	2	1	-	2	1	-	-	2	-	1	3
ET204.3	1	3	3	3	3	1	-	3	-	-	-	3	-	1	3
ET204.4	1	3	3	3	3	1	-	2	-	-	-	3	-	1	3
ET204.5	2	-	3	3	3	-	-	2	-	-	-	1	-	-	3
ET204.6	3	3	3	3	3	1	-	3	1	-	-	2	-	-	3
Average	1.66	2.33	2.83	2.5	2.66	0.66	-	2.16	0.5	-	-	2.16	-	-	3

Delivery Methods:

1. Lectures through Blackboard, Power-point slides and online Compiler.
2. Laboratory: Performance of Experiments using Turbo C++ 3.0 Compiler.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	ET204.1	**Exam,Assignments,Presentation,Experiments**
2.	ET204.2	**Exam,Assignments,Presentation,Experiments**
3.	ET204.3	**Exam,Assignments, Presentation,Experiments**
4.	ET204.4	**Exam,Assignments,Presentation,Experiments**
5.	ET204.5	**Exam,Assignments,Presentation,Experiments**
6.	ET204.6	**Exam,Assignments,Presentation,Experiments**

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ET 205: Simulation and Design Tools

CREDITS - 2 ($L=L_0$, $T=T_0$,$P=P_2$)

2^{th} Year, B. Tech. (Electronics & Telecommunication)

Course Objective: *introduce Simulation and Designing tools / software to design and simulate various analog and digital circuits,to design PCB layout for the desired circuits using PCB design tools , to generate various waveforms and to implement various electronics systems.*

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_0	T_0	P_2	C_2	ESE_0	CE_0	ESE_{30}	CE_{20}	$TOTAL_{50}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Lab work [10]
Lab File	Attendance/ lab work/viva

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Pspice Software :** Introduction to PSpice software, General purpose circuit simulation using Schematic Editor, Introduction to net list command based SPICE simulation, basic net list commands. Basic circuit analyses: DC, AC Transient.	20
2	**Introduction to PCB Design Software :** Introduction to PCB Design software, Schematic Entry, Net list Creation, Working with component libraries, Design of Boards, Layout of Parts, Optimizing Parts Placements, Pads and Via, Manual and Auto Routing, Handling Multiple Layers.	08
3	**Introduction to SCILAB :** Introduction to SCILAB, use SCILAB functions. Writing simple programs using SCILAB, handling arrays, files, plotting of functions etc. Writing SCI files for Creation of analog & discrete signals, plotting of signals etc. Simulation of electronic circuits using SCILAB.	08

List of References:

5. Stephen L. Campbell, Jean-Philippe Chancelier, and Ramine, "*Modeling and Simulation in Scilab/Scicos*", 1st edition, Springer publication, 2005
6. Rashid H. Muhammad, "*Introduction to Pspice Using Orcad for Circuits and Electronics*", 3rd edition, PHI, 2010.

Course Outcomes (Cos):

At the end of this course students will be able to…

1. design simple electronics circuits using software tools like Ngspice/LTSpice/Multisim.
2. analyze simple analog and digital circuits using simulation software Ngspice/LTSpice/Multisim
3. design PCB Layout for given circuit using PCB Software like EAGLE, Express PCB, OrCAD.
4. analyze various SCILAB command.
5. Generate various waveforms using SCILAB.
6. Analyze basic electronic system blocks using SCILAB.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET205.1	2	1	3	2	3	-	-	-	2	-	-	2	3	2	3
ET205.2	3	2	1	1	3	-	-	-	1	-	-	2	2	1	2
ET205.3	1	1	3	2	3	-	-	-	1	-	-	2	3	2	3
ET205.4	2	1	2	2	3	-	-	-	2	-	-	-	2	1	2
ET205.5	3	2	1	1	3	-	-	-	1	-	-	2	1	1	3
ET205.6	3	2	1	1	3	-	-	-	1	-	-	2	1	1	3
AVG.	1.83	1.5	1.83	1.5	3	-	-	-	1.33	-	-	1.66	2	1.33	2.66

Delivery Methods:

1. Laboratory exercises using Software tools like Ngspice/LTSpice/Multisim.
2. Presentation slides of different command of SCILAB.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	ET205.1	**Exam,Assignments,Experiments**
2.	ET205.2	**Exam,Assignments,Experiments**
3.	ET205.3	**Exam,Assignments,Experiments**

4.	ET205.4	**Exam,Assignments,Experiments**
5.	ET205.5	**Exam,Assignments,Experiments**
6.	ET205.6	**Exam,Assignments,Experiments**

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ET 206: CONTROL SYSTEM ENGINEERING

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2^{nd} Year, B. Tech. (*Electronics and Telecommunication*)

Course Objective: To explore the fundamentals of systems and control.To focus on (1) Understanding and predicting system behavior (2) Design and analysis of closed loop control systems and (3) System stability prediction.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Quiz

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Control Systems:** Introduction, Examples of Control Systems, Closed-loop Control versus Open-Loop Control, Design and Compensation of Control Systems.	05
2	**Mathematical Modeling of Control Systems :** Introduction, Transfer Function and Impulse-Response Function, Automatic Control Systems, Transformation of Mathematical Models, Mechanical Systems, Electrical and Electronic Systems, Block Diagram Reductions and Signal Flow Graphs, Linearization of Nonlinear Mathematical Models.	08

Unit No.	Topics	Teaching Hours
3	**State Variable Models:** Introduction, The State Variable of a Dynamic System, The State Differential Equation, Signal Flow Graph and Block Diagram Models using State Space, Alternative Signal Flow Graph and Block Diagram Models, The Transfer Function from the State Equation, The Time Response and State Transition Matrix.	08
4	**Feedback Control System Characteristics:** Introduction, Error Signal Analysis, Sensitivity of Control Systems to Parameter Variations, Disturbance Signals in Feedback Control System, Control of the Transition Response, Steady-State Error, The Cost of Feedback.	05
5	**Transient and Steady State Response Analysis:** Introduction, Test Input Signals, First-Order Systems, Second-Order Systems, Higher-Order Systems, Effect of third pole and a Zero on the Second Order System Response, Steady-State Errors in Unity-Feedback Control Systems, The s-plane Root Location and Transient Response, Performance Indices, Control Actions and its Effect on System Performance.	08
6	**Root Locus Analysis:** Introduction, The Concept of Stability, The Routh-Hurwitz Stability Criterion, The Relative Stability of Feedback Control System, Root-Locus Plots, General Rules for Constructing Root Loci, Design Examples using Root Locus, Conditionally Stable Systems, Lead Compensation using Root Locus, Lag Compensation, and Lag-Lead Compensation using Root Locus.	08
7	**Frequency Response Methods:** Introduction, Frequency Response Plots, Frequency Response Measurements, Performance Specification in the Frequency Domain, Log Magnitude and Phase Diagrams.	04

Unit No.	Topics	Teaching Hours
8	**Stability in the Frequency Domain:** Introduction, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability, Closed-Loop Frequency Response of Unity-Feedback Systems, Lead Compensation using Bode Diagrams, Lag Compensation, and Lag-Lead Compensation using Bode Diagrams.	09
	Total Hours.	55

List of References:

7. Richard C. Drof and Robert H. Bishop, "*Modern Control System*", Pearson Education, 11th Edition, 2008.
8. Katsuhiko Ogata, "*Modern Control Engineering*", Prentice Hall of India, 5th Edition, 2010.
9. Benjamin C. Kuo & Farid Golnaraghi, "*Automatic Control Systems*", John Wiley & Sons, 8th Edition, 2002.
10. Nagrath and Gopal, "*Control Systems Engineering*", New Age Publication, 5th Edition, 2007.

Course Outcomes (COs):

By learning this course students will be able to …

1. Gain Knowledge of Linear Differential Equation and its Solution & Laplace Transform.
2. Understand systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
3. Predict system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
4. Analyze the behavior of closed loop systems using tools such as root locus, Routh Hurwitz, Bode, Nyquist, and Matlab.
5. Explain a safe and effective method of investigating a system identification problem in the lab.
6. Design controllers using classical PID methods, root locus methods, and frequency domain methods.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET206.1	3	2	3	1	3	2	1	1	1	1	2	3	2	2	1
ET206.2	3	3	3	3	2	1	-	1	2	1	1	3	3	3	1
ET206.3	3	3	3	2	3	1	1	2	2	1	1	3	3	3	1
ET206.4	3	3	2	2	3	1	1	3	1	1	2	3	2	2	3
ET206.5	2	2	3	3	2	1	1	1	2	2	2	3	3	3	2
ET206.6	3	3	3	2	3	1	1	2	3	2	2	3	3	2	2

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
Average	2.83	2.66	2.83	2.16	2.66	1.16	0.83	1.66	1.83	1.33	1.66	3.00	2.66	2.50	1.66

Delivery Methods:

1. Lectures through Blackboard and Power-point slides.
2. Laboratory: Performance of Experiments using Control System trainer kits, Oscilloscope, Function Generator, Digital Millimeter and software MATLAB.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	ET206.1	**Exam, Assignments, Presentation,Experiments**
2.	ET206.2	**Exam,Assignments, Presentation, Experiments**
3.	ET206.3	**Exam,Assignments,Presentation,Experiments**
4.	ET206.4	**Exam,Assignments, Presentation,Experiments**
5.	ET206.5	**Exam,Assignments, Presentation,Experiments**
6.	ET206.6	**Exam,Assignments, Presentation,Experiments**

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ET207: Electronic Measurements and Instrumentation

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2nd Year, B.TECH (Electronics & TeleCommunication)

Course Objective:

To introduce fundamentals of processor control systems, signal conversions, conditioning of signals coming from transducers, transducers to measure the variety of quantities. With new technologies the topics relevant to the microcontroller/ microprocessor and PC based data acquisition system is covered to make student aware about the use of processing units in design of sensing devices.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Performance/Quiz/ Questions & Answers/ Discussion

Course Contents:

Sr. No.	Topics	Teaching Hrs.
1.	**Measurement Errors and Standards:** Definitions, Accuracy and Precision, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors	5
2.	**Introduction to Instrumentation :** Units, Standards, and Definitions: Analog Data Representation, Definitions, Sensor Time Response: first order, second order, Analog and Digital Processing	5
3.	**Analog Signal Conditioning :**Introduction, Principles of Analog Signal Conditioning, Passive Circuits, Op Amp Circuits in Instrumentation, Design Guidelines.	8
4.	**Digital Signal Conditioning:** Review of Digital Fundamentals, Converters, Data-Acquisition Systems, Characteristics of Digital Data.	8

5.	**Transducers: Thermal Sensors** :Definition of Temperature. Metal Resistance versus Temperature Devices, Thermistors, Thermocouples, Other Thermal Sensors, Design Considerations;	8
6.	**Mechanical Sensors:** Displacement, location or position sensor: Potentiometric sensor, capacitive & Inductive sensor, level sensor; Strain Sensor: metal strain gauges, semiconductor strain gauges, load cells.	6
7.	**Optical Sensors :** Fundamentals of EM Radiation, Photodetectors, Pyrometry, Optical Sources, Applications; Shaft encoders,	5
8.	**Isolation Techniques:**Transformer Isolation, Optical Isolation, Digital Techniques, For Optical Isolation.	4
9.	**Specialized IC Applications:** Voltage Regulators 78xx, the 555 Timer, Power Amplifier LM380. Sample application designs.	6
Total		**55**

List of References:

1. Curtis D. Johnson. "*Process Control Instrumentation Technology*", Prentice Hall, 8/E, 2005
2. Ramakant Gayakwad. " A. *Op-amps and linear integrated circuits*". Prentice-Hall, Inc., 1993. ISBN:0-13-630328-5
3. Kalsi H. S. "*Electronic Instrumentation*", McGraw-Hill , 2nd Ed., 2004.
4. Rangan C. S., Sarma G. R. and Mani V. S. V., "*Instrumentation Devices And Systems*", McGraw-Hill, 2nd Ed., 2004.
5. Shawhney A. K. "*A Course In Electrical And Electronics Measurements And Instrumentation*",Dhanpat Rai & Sons, 11th Ed., 1999
6. J. Bouvens, "*Digital Instrumentation*",McGraw-Hill, 1st Ed., 1997.
7. Helfrick Albert D. and Cooper W. D., "*Modern Electronic Instrumentation and MeasurementTechniques*", Prentice Hall India, 1st Ed., 1990

Course Outcomes (COs) :

At the end of this course students will be able to

1. Understand standards, characteristics, errors.
2. Understand measurement parameters and methods, sensing and measuring physical quantities.
3. Analyze working of transducer, actuators, signal conditioning circuits and control operation.
4. Design Conditioning circuit for transducers based on opamps
5. Design Transducer based monitoring system
6. Understand use and applications of microcontrollers & analog ICs for sensing system design.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET 207.1	3	-	1	-	-	-	-	-	-	-	-	1	-	-	-
ET 207.2	3	-	2	-	-	-	-	-	-	-	-	2	1	-	-

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET 207.3	3	3	2	2	1	1	-	-	-	-	-	2	1	-	-
ET 207.4	3	3	2	2	2	1	-	-	1	-	-	2	2	-	1
ET 207.5	3	3	3	3	3	2	-	-	2	-	-	3	3	-	2
ET 207.6	3	3	3	3	3	2	-	-	3	-	-	3	3	2	3
Average	3	2	1.67	1.67	1.5	1	-	-	1	-	-	2.16	1.67	0.33	1

Delivery Methods:

1. Lectures through Blackboard, power-point slides, videos, animations.
2. Laboratory: Performance of Experiments Using OpAmp kits/ICs, Components, transducer kits, Bread boards, Orcad Software, Function Generator, Oscilloscope, Digital Logic Trainer Kits, Millimeter, Power Supply, Logic Analyzer.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	ET 207.1	**Exam,Assignments, Presentation,Experiments**
2.	ET 207.2	**Exam,Assignments, Presentation,Experiments**
3.	ET 207.3	**Exam,Assignments, Presentation,Experiments**
4.	ET 207.4	**Exam,Assignments, Presentation,Experiments**
5.	ET 207.5	**Exam,Assignments,Presentation,Experiments**
6.	ET 207.6	**Exam,Assignments, Presentation,Experiments**

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ET-208 : ELECTRONICS & COMMUNICATION

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2nd Year, B. Tech. (Electronics & Telecommunication)

Course Objective :

1. Understanding electronic communication systems in analog form from deterministic approach
2. Design and analysis of analog communications systems.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Assignment [05]	Attendance [05]
Lab File preparation and understanding	Assignments/ Presentations/ Quiz	Lecture/ Laboratory attendance

Course Contents:

Unit No.	Topics	Teaching Hours
1.	**Introduction to communication systems:** Understand the Communication system, Analog and digital Messages, Channel effect, Modulation and detection, Bandwidth of different information signals, Historical review of telecommunication, Applications.	3
2.	**Signal and Signal Space:** Analysis of Size of a signal, Classification of signals, Unit Impulse Signal, Correlation Of Signal, Correlation Functions, Autocorrelation Functions	4

Unit No.	Topics	Teaching Hours
3.	**Analysis and Transmission of Signals:** A periodic signal representation by Fourier integral, Transform of some useful function, Some properties of the Fourier transform, Signal transmission through a linear system, Ideal and practical filters, Signal distortion over a communication channel, Signal energy and energy spectral density, Signal power and power spectral density.	8
4.	**Passive Circuits:** Introduction, Series tuned circuits, Parallel tuned circuits, self-capacitance of a coil, Skin effect	3
5.	**Noise:** Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise	9
6.	**Amplitude Modulations and demodulations:** Concept of modulation, Mathematical representation of sinusoidal Amplitude modulated signals in time and frequency domain- Double sideband Full carrier (DSBFC) , Double sideband suppressed carrier(DSBSC) and single sideband suppressed carrier modulations(SSBSC), Vestigial Sideband (VSB) modulation and Quadrature amplitude modulation(QAM), power and bandwidth calculations for DSBFC, DSBSC, SSBSC, VSB and QAM modulations, Non sinusoidal AM – effective modulation index, Effective voltage and current for sinusoidal and non-sinusoidal AM, AM generation: FET balanced modulator and IC balanced modulator circuits, Diode ring modulator, SSB generation: balanced modulator-filter method, phasing method and the third method, AM detection: peak (envelope detector), synchronous detectors, square law detectors.	10

Unit No.	Topics	Teaching Hours
7.	**Angle Modulation and Demodulation:** Concept of instantaneous frequency and angle modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, equivalence between Frequency modulation(FM) and Phase modulation(PM), Angle modulator circuits, FM transmitters, Armstrong method of FM generation, Fm stereo broadcast, FM detection: Basic slope detector, Foster-Seeley discriminator, ratio detector, PLL detector and Quadrature detector, Concept of Amplitude limiter, Pre-emphasis and de-emphasis circuits, Interference in angle modulated system.	11
8.	**Radio receivers:** Functions of radio receivers, working of super heterodyne radio receivers, tuning ranges, tracking, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, Electronically tuned, receivers, IC receivers, AM receivers, FM receivers	7
	Total Hours	55

List of References:

1. B.P.Lathi, Zhi Ding, "Modern Analog and Digital communication system", 4th Edition, Oxford University press, 2010
2. Dennis Roddy, John Coolen, "Electronic Communication", Fourth Edition, Prentice-Hall, 2005
3. John G. Prokis, Masoud Salehi, "Fundamentals of Communication Systems", Third Impression ,Pearson Education India, 2008
4. George Kennedy, Bernard Davis, S.R.M. Prasanna, Electronic Communication Systems, McGraw Hill Education Limited, 5th Edition, 2011
5. Sanjay Sharma,"Analog Communication Systems", Second Edition, S K Kataria & Sons, 2007

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the basics of communication system.
2. Understand different types of signals ,various noise & its effect on communication systems.
3. Analyze different type of passive circuits (Tuned circuits).
4. Analyze different signals and systems using Fourier transform.
5. understand working of Super heterodyne receiver , AM/FM Transmitters.

6. understand the basic concept amplitude, frequency & phase modulation and demodulation.

Course Articulation Matrix :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET208.1	3	3	2	1	1	1	-	-	2	2	-	-	3	2	2
ET208.2	3	2	3	2	1	-	-	-	2	2	-	-	2	2	2
ET208.3	2	3	3	2	2	-	-	-	2	2	-	-	2	2	2
ET208.4	3	3	3	3	2	-	-	-	2	2	-	-	2	2	2
ET208.5	2	3	3	2	2	-	-	-	2	2	-	-	2	2	3
ET208.6	3	3	3	3	2	-	-	-	2	2	-	-	3	3	3
Average	2.67	2.84	2.84	2.17	1.67	-	-	-	2	2	-	-	2.34	2.17	2.34

Delivery Methods:

1. Lectures: Using Black Board/ Power-point slides, videos.

2.Laboratory: Performance of Experiments Using Electronics & Communication kits and MATLAB Software for simulink communication blocks and codes to generate outputs , Function Generator, Oscilloscope, Multimeter, Power Supply, Spectrum Analyzer , etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	ET208.1	**Exam,Assignments,Experiments**
2.	ET208.2	**Exam,Assignments,Experiments**
3.	ET208.3	**Exam,Assignments,Experiments**
4.	ET208.4	**Exam,Assignments,Experiments**
5.	ET208.5	**Exam,Assignments,Experiments**
6.	ET208.6	**Exam,Assignments,Experiments**

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ET 209 : Microcontroller and Interfacing
CREDITS - 6 (L=L_4, T=T_0,P=P_2)

2nd Year, B.TECH (Electronics & TeleCommunication)

Course Objective :

To introduce RISC Architecture in AVR Atmega 32 Microcontroller,difference in RISC and CISC architecture, to design microcontroller based applications & interfacing its peripherals to other circuits.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Performance/Quiz/ Questions & Answers

Course Content :

Sr. No.	Topics	Teaching Hrs.
1.	**Introduction To 8-bit Microcontroller:** Microcontrollers and Embedded processors, Overview of AVR family, AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin.	08
2.	**AVR Instructions:** Addressing modes of AVR, Data transfer Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions. AVR data types and assembler directives, AVR assembly language programs.	07

3.	**AVR Assembly Language Programming:** AVR I/O Port Programming, Time delay loop, BCD, ASCII conversion Program, Look-up table, Bit addressability, MACROs.	08
4.	**AVR Programming in C:** Data types, I/O programming, logic operations, Intel HEX file, Timer programming in assembly and C, Interrupt programming in assembly and C, Serial Port programming in assembly and C.	15
5.	**Peripheral Interfacing & programming in C:** LCD and Keyboard Interfacing; ADC, DAC and sensor interfacing; Relay, Opto-isolator and Stepper Motor Interfacing.	10
6.	**Applications:** Input capture and Wave Generator, PWM programming and DC motor control, SPI protocol, I2C Protocol and RTC interfacing.	07
	Total Hrs.	**55**

List of References :

1. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi,The AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 1st Edition, 2012.
2. Dhananjay Gadre, Programming and Customizing the AVR Microcontroller,Mc-Graw Hill, 1st Edition,2001.
3. AVR ATmega32 data sheet.

Course Outcomes (COs)

At the end of this course students will be able to…..

1. Differentiate RISC and CISC Architecture along with its applications
2. Design Microcontroller based applications
3. Develop programs using assembly language & C language to optimize the performance.
4. Analyze and debug the microcontroller based embedded system
5. Design hardware interfacing using Atmega32 and can write & execute its programs

6. Develop header files for interfacing hardware using C language

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET209.1	3	-	1	1	-	2	-	-	-	-	-	2	-	2	-
ET209.2	3	2	3	2	1	2	-	-	1	-	-	2	3	3	2
ET209.*3*	3	2	3	3	1	2	-	-	1	-	-	2	-	3	-
ET209.4	3	3	3	3	2	2	-	-	1	-	-	2	3	3	-
ET209.*5*	3	3	3	3	3	2	-	-	1	-	-	2	3	3	2
ET209.*6*	3	2	3	2	1	2	-	-	1	-	-	2	-	3	-
Average	3.0	2.0	2.7	2.3	1.3	2.0	0.0	0.0	0.8	0.0	0.0	2.0	1.5	2.8	0.7

Delivery Methods:

1.Lectures through Blackboard/ power-point slides , videos, animations, pictures, graphics etc. **2.**Laboratory: PC, ICs,Bread boards and Software (AVR Studio - Atmel) , Function Generator, Oscilloscope, Digital Logic Trainer Kits, Multimeter, Power Supply, Logic Analyzer,etc.

Consumable Items: Various logic ICs for logic gates, flip-flops, latch, decoders, encoders, multiplexers, demultiplexer Bread Board, Function Generator, Oscilloscope, Digital Logic Trainer Kits, Multimeter, Power Supply, Logic Analyzer,etc. - Consumable Items: Various logic ICs for logic gates, flip-flops, latch, decoders, encoders, multiplexers, demultiplexer, etc., hook-up wires, Soldering iron, Desoldering pump, Electronics Toolkit, duplexer, etc., hook-up wires, Soldering iron, Desoldering pump, Electronics Toolkit etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	ET209.1	Exam,Project, Presentation,Experiments
2.	ET209.2	Exam,Project, Presentation,Experiments
3.	ET209.*3*	Exam,Project, Presentation,Experiments
4.	ET209.4	Exam,Project, Presentation,Experiments
5.	ET209.*5*	Exam,Project, Presentation,Experiments
6.	ET209.*6*	Exam,Project, Presentation,Experiments

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ET210: Mini Project
CREDITS - 2 (L=L_0, T=T_0,P=P_2)

2^{th} Year, B. Tech. (Electronics & TeleCommunication)

Course Objective

To develop ability and knowledge of practical tools in order to solve real life problems related to the industry, institutions and research & individual commercial or Technical hardware or software Project.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_0	T_0	P_2	C_2	ESE_{00}	CE_{00}	ESE_{30}	CE_{20}	$Total_{50}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Report/Presentation	Performance/Questions & Answers/ Discussion

Course Contents :

Guidelines:

1. Students should select a problem which addresses some basic real life applications.
2. The electronic mini Project for selected problem should have at least 20 to 25 Components.
3. Students should understand testing of various components.
4. Soldering of components should be carried out by students.
5. Students should develop a necessary Layout and PCB for the circuit.
6. Students should see that final circuit submitted by them is in working condition.
7. 15-20 pages report to be submitted by students.
8. Group of maximum three students can be permitted to work on a single mini project.
9. The mini project must have hardware part. The software part is optional.
10. Demonstration with poster/seminar presentation of all mini projects developed by the students at the end of semester.

Course Outcomes (COs):

After successfully completing this course, the student shall be able to:

1. Understand, plan and execute a Mini Project with team.
2. Implement electronic hardware by learning PCB artwork design, soldering techniques, trouble shooting etc.
3. Prepare Project Software by efficient algorithm Mini project.
4. Apply latest trends and technology in selected project.
5. Prepare a technical report based on the Mini project.
6. Deliver technical seminar based on the Mini Project work carried out.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ET210.1	3	3	3	3	3	2	-	2	3	3	3	2	3	3	3
ET210.2	2	3	3	3	3	2	-	2	2	2	3	2	3	2	3
ET210.3	2	2	2	2	1	1	-	-	2	2	1	2	1	1	1
ET210.4	2	3	2	2	3	1	-	-	3	3	1	2	1	1	1
ET210.5	2	2	2	2	1	1	-	-	2	2	1	-	1	1	1
ET210.6	2	3	2	2	3	1	-	-	3	3	1	2	1	1	1
AVG.	2.16	2.66	2.33	2.33	2.33	1.33	-	0.66	2.33	2.33	1.66	1.66	1.66	1.5	1.66

Delivery Methods :

1. Laboratory exercises with guideline of project Hardware/Software.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	CE (Theory) [30]		ESE [Theory] [70]	ESE [practical] [30]	CE [Practical] [20]
		Mid Semester I [15]	Mid Semester II [15]			
1.	ET210.1	-	-	-	10%	10%
2.	ET210.2	-	-	-	20%	20%
3.	ET210.3	-	-	-	20%	20%
4.	ET210.4	-	-	-	10%	10%
5.	ET210.5	-	-	-	20%	20%
6.	ET210.6	-	-	-	10%	10%

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AGENDA	DISCRIPTION
ET1617.1.5	**To revise teaching scheme & structure of Third level (SEM –V & SEM -VI) (Revised Annexure – IV) & Final level (SEM –VII & SEM – VIII) of the UG (Electronics & TeleCommunication Engineering) Programme (Revised Annexure – V).**

Programme Structure (Proposed and Approved) for **Third Level** of UG Electronics and Telecommunication Engg. Programme under BVM (Autonomous) w.e.f Academic Year : 2017-18

5.1 . Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
5.1	Dr. N.J Kothari ,Dr. M.B shah	ET BoS	Include power electronics as core subject instead of probability & statistics, include contents of probability & statistics in digital communication Subject, Keep open elective in sixth Semester.
5.2	Dr. N.J Kothari ,Dr. M.B shah,Mr. Krunal Patel	ET BoS	Instead of DCN-I & DCN-II subjects offer Data communication and networking & Cryptography and Security subjects .
5.3	Dr. N.J Kothari ,Mr. Krunal Patel,Prof. Anish Vahora	ET BoS	Replace Wave Propagation and Antennas subject with Antennas & Microwaves subject. Replace Linux Programming & scripting languages elective with scripting languages as Lab.

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Programme Structure (**Revised**) for **Third Level** of UG Electronics and Telecommunication Programme under BVM (Autonomous) w.e.f Academic Year: 2017-18

ANNEXTURE –IV (Revised)

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
			L	T	P	H	C	M	E	I	V	TOTAL
		Semester - V										
1.	PC	Engineering Electromagnetics	4	0	0	4	4	30	70	00	00	100
2.	PC	Power Electronics	3	0	2	5	5	30	70	20	30	150
3.	PC	Data communication and Networking	4	0	2	6	6	30	70	20	30	150
4.	PC	VLSI Design	3	0	2	5	5	30	70	20	30	150
5.	PC	Advance Microprocessors	4	0	2	6	6	30	70	20	30	150
6.	PC	Engineering Design -I	0	0	2	2	2	00	00	20	30	50
7.	PC	Scripting Languages	0	0	2	2	2	00	00	20	30	50
			18	**0**	**12**	**30**	**30**	**150**	**350**	**120**	**180**	**800**
		Semester - VI										
1.	PC	Digital Communication	4	0	2	6	6	30	70	20	30	150
2.	PC	Digital Signal Processing	4	0	2	6	6	30	70	20	30	150
3.	PC	Application Specific Integrated Circuit (ASIC) Design	4	0	2	6	6	30	70	20	30	150
4.	PE	Open Elective	3	0	2	5	5	30	70	20	30	150
5.	PE	Engineering Design -II	0	0	2	2	2	00	00	20	30	50
5.	PE	**Programme Elective – I**	3	0	2	5	5	30	70	20	30	150
		Telecom and Switching **OR** Cryptography and Security										
		Total	**18**	**0**	**12**	**30**	**30**	**150**	**450**	**120**	**180**	**800**

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Programme Structure (Revised & Approved) for **Fourth Level** of UG Electronics and Telecommunication under BVM (Autonomous) w.e.f Academic Year: 2018-19

ANNEXTURE -V

Sr. No	Code	Course	Teaching Scheme					Evaluation Scheme				
		Semester - VII	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL**
1	PC	Antennas and Microwaves	4	0	2	6	6	30	70	20	30	150
2	PC	Embedded Systems	4	0	2	6	6	30	70	20	30	150
3	PC	Optical Communication	3	0	2	5	5	30	70	20	30	150
3	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5	PE –II	Program Elective – II ASIC Verification Biomedical and Instrumentation	3	0	2	5	5	30	70	20	30	150
6	PE-III	Program Elective – III Image Processing Virtual Instrumentation	3	0	2	5	5	30	70	20	30	150
		TOTAL	**15**	**0**	**16**	**31**	**31**	**150**	**450**	**150**	**150**	**900**
		Semester - VIII										
7	PC	Wireless Communication	4	0	2	6	6	30	70	20	30	150
8	PC	Project - II	0	0	18	18	18	00	200	50	00	250
9	PE	Program Elective – IV Advance Communication Systems Analog VLSI Design	4	0	2	6	6	30	70	20	30	150
		Total	**8**	**0**	**22**	**30**	**30**	**60**	**340**	**90**	**60**	**550**

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AGENDA	DISCRIPTION
ET1617.1.6	**To discuss & Approve Equivalency of Second level autonomy subjects with Equivalent Gujarat technological University (GTU) Subjects (ANNEXTURE - VI).**

ANNEXTURE -VI

Table of Equivalence with GTU syllabus

Sr. No.	GTU		Autonomy		
	Semester	Code and Subject	Semester	Code and Subject	
1.	3	(2131006) Electronic Devices and Circuits	1	(CC 141) Fundamentals of electronics	
2.	3	(2130901) Circuits and Networks	3	(ET 202) Network Analysis And Synthesis	
3.	3	(2131004) Digital Electronics	3	(ET 203) Digital Circuit Design	
4.	4	(2141002) Analog Circuit Design	3	(ET 201) Electronic Devices and Circuits	
5.	4	(2141003) Electronics Measurement and	4	(ET 207) Electronic Measurements and Instrumentation	

		Instrumentation			
6.	4	(2141004) Control System Engineering	4	(ET 206) Control System Engineering	
7.	4	(2141006) Simulation and Design Tools	3	(ET 205) Simulation and Design Tools	

List of Subjects which are to be registered by the student in lieu of GTU subjects.

Sr. No.	GTU		Autonomy		
	Semester	Code and Subject	Semester	Code and Subject	
1.	3	(2130005) Design Engineering - I A	3	(ET 204) Object Oriented Programming	
2.	4	(2140002) Design Engineering – I B	4	(ET 210) Mini Project	
3.	4	(2140304) Microprocessor and Interfacing	4	(ET 209) Microcontroller and Interfacing	

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4.	4	(2141005) Signals & Systems	4	(ET 208) Electronics and Communication	

AGENDA	DISCRIPTION
ET1617.1 7	**Revised Teaching scheme for two second level Autonomy subjects. (1) ET-205 Simulation & Design Tools (2) ET - 210: Mini project .(** ANNEXTURE –VII)

ANNEXTURE –VII

ET 205: Simulation & Design Tools

Teaching Scheme			Credits	Marks Distribution				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	2	-	-	30	20	50

ET 210: Mini Project

Teaching Scheme			Credits	Marks Distribution				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	2	-	-	30	20	50

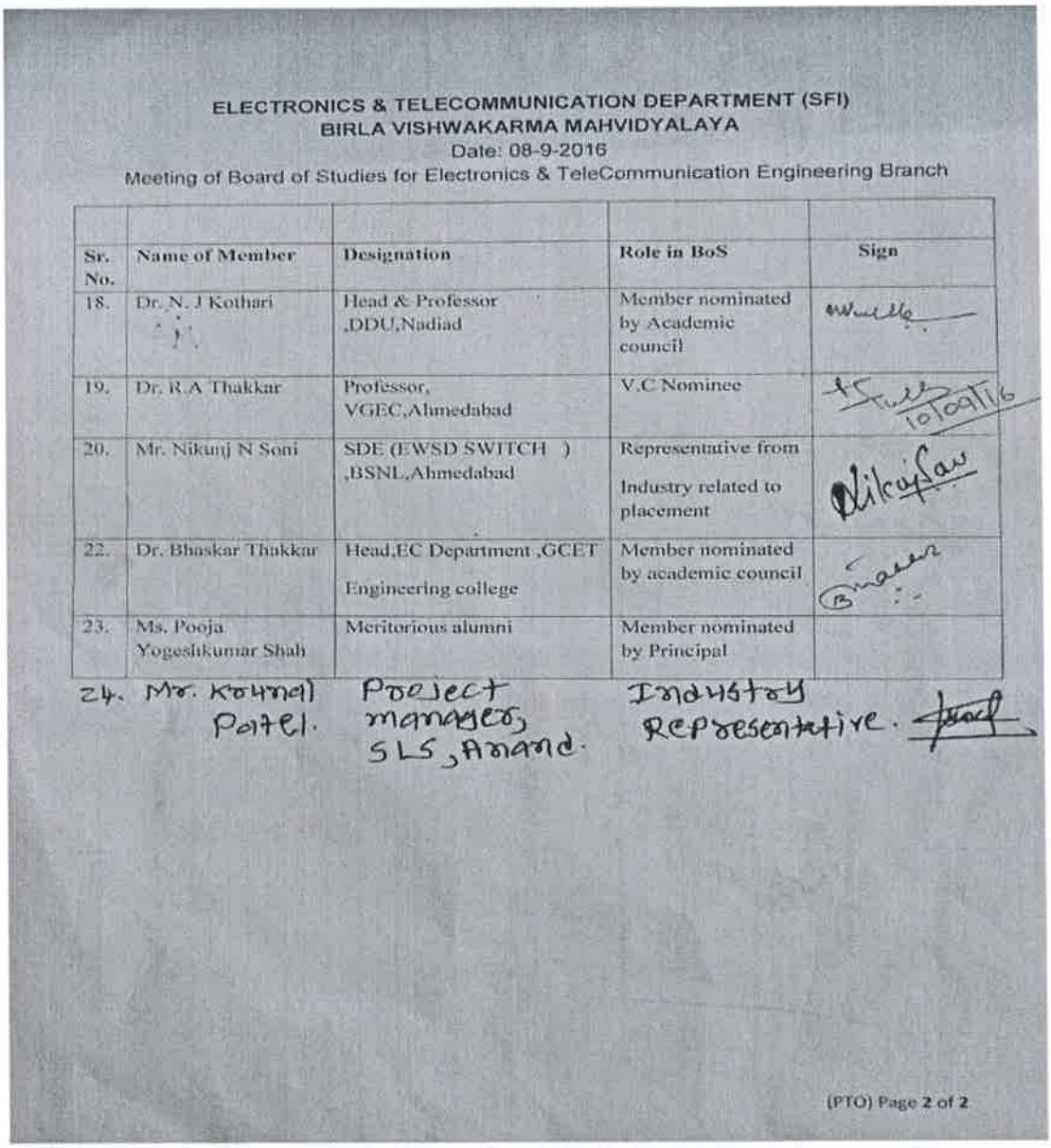
M. B. Shah

Dr. M. B. Shah
Chairman, BoS, ET
BVM (Autonomous)

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ANNEXTURE –VIII

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ELECTRONICS & TELECOMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA
Date: 08-9-2016
Meeting of Board of Studies for Electronics & TeleCommunication Engineering Branch

Sr. No.	Name of Member	Designation	Role in BoS	Sign
18.	Dr. N. J Kothari	Head & Professor ,DDU,Nadiad	Member nominated by Academic council	
19.	Dr. R.A Thakkar	Professor, VGEC,Ahmedabad	V.C Nominee	10/09/16
20.	Mr. Nikunj N Soni	SDE (EWSD SWITCH) ,BSNL,Ahmedabad	Representative from Industry related to placement	
22.	Dr. Bhaskar Thakkar	Head,EC Department ,GCET Engineering college	Member nominated by academic council	
23.	Ms. Pooja Yogeshkumar Shah	Meritorious alumni	Member nominated by Principal	
24.	Mr. Kaunal Patel.	Project manager, SLS, Anand.	Industry Representative.	

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M. B. Shah

Dr. M. B. Shah
Chairman, BoS, ET
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ELECTRONICS & TELECOMMUNICATION DEPARTMENT
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ELECTRONICS & TELECOMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA

Date: 08-9-2016

Meeting of Board of Studies for Electronics & TeleCommunication Engineering Branch

Board of the Meeting

Sr. No.	Name of Member	Designation	Role in BoS	Sign
1	Dr. M.B. Shah	Asso. Professor,ET,BVM	**Chairman**	
2	Prof. Kaushal Patel	Asst.Professor,ET,BVM	Secretary	
3	Dr. B.C.Goradia	Asso.Professor,ET,BVM	Faculty Member	
4	Prof.A. B Bambhaniya	Asst. Professor,ET,BVM	Faculty Member	
5	Prof. P.S. Bhakhar	Asst.Professor,ET,BVM	Faculty Member	
6	Prof.Darshan Dalwadi	Asso.Professor,ET,BVM	Faculty Member	
7	Prof.Hiren Patel	Asst. Professor,ET,BVM	Faculty Member	
8	Prof.Robinson Paul	Asst. Professor,ET,BVM	Faculty Member	
9	Prof.G.B Rathod	Asst. Professor,ET,BVM	Faculty Member	
10	Prof.Ripal Patel	Asst. Professor, ET, BVM	Faculty Member	
11	Prof.Palak Patel	Asst. Professor, ET, BVM	Faculty Member	
12	Dr. S.R. Unadkat	Asst. Professor, ET, BVM	Faculty Member	
13	Prof.Anish Vahora	Asst. Professor, ET, BVM	Faculty Member	
14	Prof. R.C.Rana	Asst. Professor, ET, BVM	Faculty Member	
15	Prof.Amit Choksi	Asst. Professor, ET, BVM	Faculty Member	
16	Prof.Ronak Vashi	Asst. Professor, ET, BVM	Faculty Member	
17	Prof.Mayur Sevak	Asst. Professor, ET, BVM	Faculty Member	

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Meeting of **BOS** of Electronics & Communication Engineering Branch, BVM (Autonomous), was held at **10:30 AM** on Date: 0**8-04-2017** for the following agenda items :

AGENDA ITEM 1: EC1718.1.1

AGENDA	DISCRIPTION
EC1718.1.1	To Discuss, suggest and approve amendment in Third level Teaching structure & syllabus as per Annexture – I.

Old Programme Structure (Approved During BOS Meeting EC1617.1) for **Third Level** of UG Electronics and Communication under BVM (Autonomous).

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
			L	T	P	H	C	M	E	I	V	TOTAL
		Semester – V										
1.	PC	Engineering Electromagnetics	4	0	0	4	4	30	70	00	00	100
2.	PC	Power Electronics	3	0	2	5	5	30	70	20	30	150
3.	PC	Data communication and Networking	4	0	2	6	6	30	70	20	30	150
4.	PC	VLSI Design	3	0	2	5	5	30	70	20	30	150
5.	PC	Advance Microprocessors	4	0	2	6	6	30	70	20	30	150
6.	PC	Engineering Design - I	0	0	2	2	2	00	00	20	30	50
7.	PC	Scripting Languages	0	0	2	2	2	00	00	20	30	50
			18	**0**	**12**	**30**	**30**	**150**	**350**	**120**	**180**	**800**
		Semester - VI										
1.	PC	Digital Communication	4	0	2	6	6	30	70	20	30	150
2.	PC	Digital Signal Processing	4	0	2	6	6	30	70	20	30	150
3.	PC	Application Specific Integrated Circuit Design	4	0	2	6	6	30	70	20	30	150

4.	OE	Open Elective - I	3	0	2	5	5	30	70	20	30	150
		Applied Electronics										
5.	PE	Engineering Design - II	0	0	2	2	2	00	00	20	30	50
5.	PE	**Programme Elective – I**	3	0	2	5	5	30	70	20	30	150
		Telecom and Switching **OR** Cryptography and Security										
		Total	**18**	**0**	**12**	**30**	**30**	**150**	**450**	**120**	**180**	**800**

Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
1.1	Er .Nikunj Soni	EC BoS	Remove Telecom & Switching subject due to obsolete contents & include Next Generation Networks .
1.2	Dr. B.C Goradiya	EC BoS	We have lab develop for Telecom & Switching ,it will take some time to develop lab for Next Generation Networks Subject .We might consider NGN subject in nearest future as per the availability of lab.
1.3	Dr. Bhasker Thakkar	EC BoS	

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Programme Structure (Proposed & Approved) for **Third Level** of UG Electronics and Communication Branch under BVM (Autonomous) w.e.f Academic Year: 2017-18

ANNEXTURE I

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
		Semester - V	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL**
1.	PC	Engineering Electromagnetics	3	2	0	5	5	30	70	00	00	100
2.	PC	Power Electronics	3	0	2	5	5	30	70	20	30	150
3.	PC	Digital Signal Processing	4	0	2	6	6	30	70	20	30	150
4.	PC	VLSI Design	4	0	2	6	6	30	70	20	30	150
5.	PC	Advance Microprocessors	4	0	2	6	6	30	70	20	30	150
6.	PC	Design Engineering	0	0	2	2	2	00	00	20	30	50
		Total	18	2	10	30	30	150	350	100	150	750
		Semester - VI	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL**
1.	PC	Digital Communication	4	0	2	6	6	30	70	20	30	150
2.	PC	Antenna and Wave Propagation	4	0	2	6	6	30	70	20	30	150
3.	PC	Embedded Systems	4	0	2	6	6	30	70	20	30	150
4.	OE	Open Elective - I	3	0	2	5	5	30	70	20	30	150
		Applied Electronics										
5.	PC	Scripting Languages	0	0	2	2	2	00	00	20	30	50
5.	PE	**Programme Elective – I**	3	0	2	5	5	30	70	20	30	150
		Telecom and Switching										
		Industrial Automation										
		Digital Systems Design Using VHDL										
		Total	**18**	**0**	**12**	**30**	**30**	**150**	**450**	**120**	**180**	**800**

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EC 301: Engineering Electromagnetics

CREDITS - 5 (L=L_3, T=T_2,P=P_0)

3rd **Year, B.Tech. (*Electronics and Communication*)**

Course Objective:
To provide strong khowledge of Basic principles, laws and Theorms of electromagnetism to understand transmission, radiation and propagation for physical interpretation and applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_2	P_0	C_5	ESE_{70}	CE_{30}	ESE_{00}	CE_{00}	$Total_{100}$

Details of AssessmentInstruments under CE Practical Component: NA

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Vector Calculus, Coordinates systems and Transformation:** Scalar and Vector quantities and its addition, subtraction and multiplication, Unit vector, Cartesian, Cylindrical and Spherical coordinate systems, Transformation between coordinate systems.	**06**	**08**
2.	**Electrostatics:** Different types of charge distribution(Charge Family), Coulombs law, Electric field intensity due to different charge distributions, Stream lines,Electric flux density, Gauss's law and its application, Divergence, Divergencetheorem, Del operator, Maxwell's first equation.	**08**	**20**

Unit No.	Topics	Teaching Hours	% Weightage
3.	**Energy and Potential:** Energy Expended in Moving a Point Charge in an Electric Field, The LineIntegral, Definition of Potential Difference and Potential, The Potential Field ofa Point Charge, The Potential Field of a System of Charges: ConservativeProperty, Potential Gradient, The Electric Dipole, Energy Density in theElectrostatic Field.Poisson's and Laplace's Equations,Examples and Solutionof Laplace's Equation,Example of the Solution of Poisson's Equation.	**08**	**20**
4.	**Conductors and Dielectrics:** Current and Current Density, Continuity of Current,Conductor Properties,Natureof Dielectric Materials, Boundary Condition between ideal conductorand perfect dielectric, Boundary Conditions between Perfect DielectricMaterials. Capacitance for parallel plates.	**05**	**10**
5.	**Magneto-statics:** Continuity equation, Biot-Savart law, Ampere's circuital law and its applications, Magnetic Flux and Magnetic Flux Density, Curl, Stokestheorem, Expressionfor stored energy in magneto-static field, Scalar and Vector Magnetic Potential, Magnetic boundary condition.	**07**	**15**
6.	**Magnetic Forces, Materials and Inductance:** Force on a Moving Charge,Force on a Differential Current Element,Hall Effect,Force between Differential Current Elements, Force and Torque on aClosed Circuit,The Nature of Magnetic Materials,Magnetizationand Permeability,Magnetic Boundary Conditions,The Magnetic Circuit,Potential Energy and Forces on Magnetic Materials.	**07**	**12**
7.	**Time varying field and Maxwell's equations:** Faraday's Law, Displacement Current, Maxwell's Equations in Point Form,Maxwell's Equations in Integral Form,The Retarded Potentials.	**04**	**15**
	Total Hours	55	100 %

List of References:

1. William H Hayt And John A Buck, "*Engineering Electromagnetics*", McGraw-Hill Publication, Eighth Edition,2014
2. Matthew N. O. Sadiku , "*Principles of Electromagnetics*",Sixth Edition, Oxford university press, 2015
3. J.D.Kraus and Daniel Fleisch , "*Electromagnetics applications*",Fifth edition, Mcgraw Hill Pub.,2010

4. Karl Erik Lonngren,Sava VasilevSavov,"*Fundamentals of Electromagnetics with MATLAB*",Sci Tech Publishing,2007

Course Outcomes (COs):
By learning this course students will be able to …

1. Provide the knowledge of sources and generation of static electric and static magnetic fields.
2. Understand& Apply Coulomb law, Gauss law, Biot Savart law and Amperes Circuital law.
3. Clarify the physical interpretation and application of divergence, curl and gradient.
4. Analyze the electromagnetic waves using divergence, Poynting's and stock's theorem.
5. Design and test the Conductor,Dielectrics,Capacitors and Transmission Line.
6. Analyze EM waves using Maxwell's , Poisson's and Laplace equations.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.1	2	3	1	2	2	2	2	1	1	2	-	1	1	1	2
PC.2	2	3	1	2	2	2	2	2	1	2	-	1	1	1	2
PC.3	2	3	1	2	2	2	2	3	1	2	-	1	1	1	2
PC.4	2	3	1	2	2	2	2	1	1	2	-	1	1	1	2
PC.5	3	2	3	3	2	2	2	2	2	3	-	1	2	1	1
PC.6	2	3	1	2	2	2	2	3	1	2	-	1	1	1	2
Average	2.167	2.83	1.33	2.167	2	2	2	2	1.167	2.167	-	1	1.167	1	1.83

Delivery Methods:

1. Lectures through Blackboard/ power-point slides.
2. Tutorials using black board and MATLAB software.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	Co.1	**Exam,Assignments,Presentations, Problem set,Tutorial.**
2.	Co.2	**Exam,Assignments,Problemset**
3.	Co.3	**Exam,Assignments,Presentations,Problemset**
4.	Co.4	**Exam,Assignments,Problemset**

5.	Co.5	**Exam,Assignments,Tutorial.**
6.	Co.6	**Exam,Assignments,Problemset, Tutorial.**

EC 303: DIGITAL SIGNAL PROCESSING

CREDITS - 6 (L=4, T=0, P=2)

3rd Year, B. Tech. (Electronics & Telecommunication)

Course Objective:

To study various transform techniques to analyze discrete time signals and systems in time and frequency domain, design of digital filters and DSP processor with its applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Assignment [05]	Attendance [05]
Lab File/Viva	Assignments/ Presentations/ Quiz	Laboratory Attendance

Course Contents:

Unit No.	Topics	Teaching Hours	Weighted %
1.	**Introduction :** Signals, systems and signal processing, Classification of signals, Elements of digital signal processing system, Concept of frequency in Continuous and Discrete time signals, Periodic sampling, Frequency domain representation of sampling, Reconstruction of band limited signals from its samples, General applications of DSP.	6	8

Unit No.	Topics	Teaching Hours	Weighted %
2.	**Discrete-Time Signals and Systems :** Discrete-Time signals, Discrete-Time systems, LTI systems, Properties of LTI systems, Linear convolution and its properties, Discrete-Time systems described by Linear Constant Coefficient Difference Equations (LCCDE), Correlation of Discrete-Time systems, Frequency domain representation of Discrete-Time signals and systems, Representation of sequences by Discrete Time Fourier Transform, (DTFT), Properties of DTFT, Inverse DTFT.	8	13
3.	**The Z- Transform and Analysis Linear Time-of Invariant System :** Z-Transform, Properties of ROC for Z-transform, The inverse Z-transform methods, Z-transforms properties, Relationship between Fourier transform and Z-transform, Analysis of LTI systems in time domain and stability considerations using Z-transform, Frequency response of LTI system, System functions for systems with Linear Constant-Coefficient Difference Equations (LCCDE), Frequency response of rational system functions relationship between magnitude & phase, All pass systems, Inverse systems, Minimum-Maximum and Mixed phase systems, Systems with linear phase.	10	15
4.	**Structures for Discrete Time Systems :** Block Diagram and signal flow diagram representations of Linear Constant-Coefficient Difference Equations (LCCDE), Basic structures of IIR systems, Cascade form structures, Parallel form structures and Transposed forms, Direct and Cascade form structures for FIR Systems, Effects of Co-efficient quantization, Round-off errors in digital FIR filters.	8	12
5.	**Filter Design Techniques :** Fundamentals of filter design, Ideal filters and Approximations, Design of Discrete-Time IIR filters from Continuous-Time filters, Approximation by derivatives, Impulse invariance and Bilinear transformation methods, Frequency warping concept, Design of FIR filters by windowing techniques, Comparison between IIR and FIR filters.	8	15

Unit No.	Topics	Teaching Hours	Weighted %
6.	**Discrete-Fourier Transform :** Representation of periodic sequences: The Discrete Fourier Series (DFS) and its properties, Fourier transform of periodic signals, Sampling the fourier transform, The Discrete-Fourier Transform (DFT), Properties of DFT, Linear convolution using DFT, Linear filtering methods based on DFT, Linear Filtering of long data sequences: Overlap save and Overlap add Methods.	8	15
7.	**Fast Fourier Transform :** Computational complexity of direct Computation of DFT, Goertzel Algorithm, DIT-FFT algorithm, DIF-FFT algorithm, Comparison between DIT and DIF algorithm, Computation of IDFT using FFT algorithms.	7	15
8.	**DSP Processors :** Introduction to Fixed point Digital Signal Processors, TMS320C2000 series DSP-Architecture, Central processing unit, Program control, programming issues, System issues, Applications, Introduction to floating point Digital Signal Processors.	5	7
	Total Hours	60	100%

List of References:

1. Proakis & Manolakis, "*Digital Signal Processing: Principles, Algorithm & Application*", 4th edition, Pearson Education, 2006.
2. S.Salivahanan, *"Digital Signal Processing"*, 3rd edition, McGraw Hill Education, 2014.
3. LiTan, "*Digital Signal Processing fundamentals and applications*", 2nd Edition, Elsevier, 2013.
4. S.K.Mitra, *"Digital Signal Processing – A computer based Approach"*, 3rd edition, McGraw Hill, 2006.
5. B.Venkatramani, M Bhaskar, *"Digital Signal Processors, Architecture, programming and applications"*, 2nd edition, Mc-Graw Hill, 2002.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the basics of discrete and continuous, time and frequency domains.
2. Identify various properties of discrete time systems.

3. Apply mathematical techniques for the solution of discrete time systems.
4. Analyze different type of discrete time systems using Z transform and Fourier transforms.
5. Design and analysis of the frequency response of various digital filters.
6. Understand the difference between fixed point and floating point DSP processor.

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	1	3	1	1	1	-	2	2	1	1	3	1	1	2
CO.2	3	3	3	3	1	1	-	3	2	2	2	2	2	2	2
CO.3	3	3	3	3	3	2	-	3	2	2	2	3	2	2	2
CO.4	3	3	3	3	3	2	-	3	2	2	3	3	3	3	3
CO.5	3	3	3	3	3	3	1	2	2	2	2	2	3	3	3
CO.6	2	2	3	3	2	3	1	2	2	2	2	3	3	2	2
Average	2.83	2.50	3.00	2.67	2.16	2.00	0.33	2.50	2.00	1.83	2.00	2.66	2.33	2.16	2.33

Delivery Methods:

1. Lectures: Using Black Board/ Power-point slides, Videos.

2. Laboratory: Performance of experiments using DSP kits and MATLAB/SCILAB/CC Studio Software to generate applicable outputs.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**
2.	CO.2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Exam, Assignments, Presentation, Experiments**
5.	CO.5	**Exam, Assignment, Presentation, Experiments**
6.	CO.6	**Exam, Assignment, Presentation, Experiments**

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EC 304 : VLSI Design

CREDITS - 6 (L_4, T=T_0,P=P_2)

3nd Year, B.TECH (Electronics & Communication)

Course Objective: The course intends to provide an overview of the principles, operation and application of the analog building blocks like diodes MOSFET etc for performing various functions as well as introduce the technology, design concepts, electrical properties and modeling of Very Large Scale Integrated circuits.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File-Quiz	Performance-Viva/ Presentations

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage
1.	**Introduction and Fabrication of MOSFET :** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, Style for digital system design, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.	**10**	**17%**

Unit No.	Topics	Teaching Hours	Weightage
2.	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and smallgeometry effects, MOSFET capacitances	**11**	**18%**
3	**MOS Inverters: Static characteristics** Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement and Depletion type MOSFET load), CMOS Inverter,	**09**	**15%**
4.	**MOS Inverters: Switching characteristics and Interconnect Effects :** Delay-time definitions, Calculation of Delay times, CMOS Ring oscillator Circuit, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.	**08**	**14%**
5.	**Combinational and Sequential MOS Logic Circuits and Dynamic Logic Circuits:** Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs).Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop. Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.	**10**	**17%**

Unit No.	Topics	Teaching Hours	Weightage
6.	**Chip I/P, O/P Circuits, Design for testability and Introduction to FINFET:** On chip Clock Generation and Distribution, Latch –Up and its Prevention. Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self Test (BIST) techniques, current monitoring IDDQ test, Introduction to FINFET.	**12**	**19%**
	Total Hrs.	**60**	**100%**

Reference Books :

1. Sung – Mo Kang, Yusuf Leblebici, "*CMOS Digital Integrated circuits – Analysis and Design*",3 edition,McGraw Hill Education, 2002
2. Adel S. Sedra, Kenneth C. Smith, "*Microelectronic Circuits*", Sixth Edition, Oxford University, 2013.
3. Douglas A. Pucknell and Kamran Eshraghian, "*Basic VLSI Design*" , 3rd edition, PHI Learning, 2009.
4. John P. Uyemura, "*Introduction to VLSI Circuits & Systems*" 1st edition, Wiley, 2001
5. Yogesh Chauhan, Darsen Duane Lu, Vanugopalan Sriramkumar, Sourabh Khandelwal Juan Duarte ,Navid Payvadosi, Ai Niknejad, Chenming Hu "FinFET Modeling for IC Simulation and Design", 1st edition, BSIM-CMG Standard, February 2015.

Course Outcomes (COs):

1. Mathematical methods and circuit models in analysis of CMOS digital electronics circuits.
2. Understanding of the electrical and physical properties of Metal Oxide Semiconductor system.
3. To have an understanding of the static characteristics of CMOS circuit.

4. To have an understanding of the dynamic (Switching) characteristics of CMOS circuit.
5. Layout rules in the placement and routing and interconnect, and to verify the functionality, timing, power, and parasitic effects.
6. To complete VLSI design project having a set of objective criteria and design constraints.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	3	3	2	2	1	-	1	-	1	-	3	3	3
CO.2	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.3	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.4	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.*5*	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.*6*	3	3	3	3	3	3	1	-	3	-	1	-	3	3	3

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: **Software: Microwind 3.5**

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam, Assignments, Presentation,Experiments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments**
3.	*CO.3*	**Exam,Assignments, Presentation,Experiments**
4.	CO.4	**Exam, Assignments, Presentation,Experiments**
5.	CO.*5*	**Exam, Assignment, Presentation,Experiments**
6.	CO.*6*	**Exam, Assignments, Presentation,Experiments**

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EC 304 : VLSI Design

CREDITS - 6 (L_4, T=T_0,P=P_2)

3nd Year, B.TECH (Electronics & Communication)

Course Objective: The course intends to provide an overview of the principles, operation and application of the analog building blocks like diodes MOSFET etc for performing various functions as well as introduce the technology, design concepts, electrical properties and modeling of Very Large Scale Integrated circuits.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File-Quiz	Performance-Viva/ Presentations

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage
1.	**Introduction and Fabrication of MOSFET :** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, Style for digital system design, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.	**10**	**17%**

Unit No.	Topics	Teaching Hours	Weightage
2.	**MOS Transistor:** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and smallgeometry effects, MOSFET capacitances	**11**	**18%**
3	**MOS Inverters: Static characteristics** Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement and Depletion type MOSFET load), CMOS Inverter,	**09**	**15%**
4.	**MOS Inverters: Switching characteristics and Interconnect Effects :** Delay-time definitions, Calculation of Delay times, CMOS Ring oscillator Circuit, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.	**08**	**14%**
5.	**Combinational and Sequential MOS Logic Circuits and Dynamic Logic Circuits:** Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs).Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop. Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.	**10**	**17%**

Unit No.	Topics	Teaching Hours	Weightage
6.	**Chip I/P, O/P Circuits, Design for testability and Introduction to FINFET:** On chip Clock Generation and Distribution, Latch –Up and its Prevention. Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self Test (BIST) techniques, current monitoring IDDQ test, Introduction to FINFET.	**12**	**19%**
	Total Hrs.	**60**	**100%**

Reference Books :

1. Sung – Mo Kang, Yusuf Leblebici, "*CMOS Digital Integrated circuits – Analysis and Design*",3 edition,McGraw Hill Education, 2002
2. Adel S. Sedra, Kenneth C. Smith, "*Microelectronic Circuits*", Sixth Edition, Oxford University, 2013.
3. Douglas A. Pucknell and Kamran Eshraghian, "*Basic VLSI Design*" , 3rd edition, PHI Learning, 2009.
4. John P. Uyemura, "*Introduction to VLSI Circuits & Systems*" 1st edition, Wiley, 2001
5. Yogesh Chauhan, Darsen Duane Lu, Vanugopalan Sriramkumar, Sourabh Khandelwal Juan Duarte ,Navid Payvadosi, Ai Niknejad, Chenming Hu "FinFET Modeling for IC Simulation and Design", 1st edition, BSIM-CMG Standard, February 2015.

Course Outcomes (COs):

1. Mathematical methods and circuit models in analysis of CMOS digital electronics circuits.
2. Understanding of the electrical and physical properties of Metal Oxide Semiconductor system.
3. To have an understanding of the static characteristics of CMOS circuit.

4. To have an understanding of the dynamic (Switching) characteristics of CMOS circuit.
5. Layout rules in the placement and routing and interconnect, and to verify the functionality, timing, power, and parasitic effects.
6. To complete VLSI design project having a set of objective criteria and design constraints.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	3	3	2	2	1	-	1	-	1	-	3	3	3
CO.2	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.3	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.4	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.*5*	3	3	3	2	2	2	1	-	1	-	1	-	3	3	3
CO.*6*	3	3	3	3	3	3	1	-	3	-	1	-	3	3	3

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: **Software: Microwind 3.5**

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam, Assignments, Presentation,Experiments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments**
3.	*CO.3*	**Exam,Assignments, Presentation,Experiments**
4.	CO.4	**Exam, Assignments, Presentation,Experiments**
5.	CO.*5*	**Exam, Assignment, Presentation,Experiments**
6.	CO.*6*	**Exam, Assignments, Presentation,Experiments**

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EC 305: ADVANCED MICROPROCESSORS

CREDITS - 6 (L_4,T=T_0,P=P_2)

3nd Year, B.TECH (Electronics & Communication)

Course Objective:
To learn architecture, instruction set and programming of various Microprocessors like 8086, 80286, Pentium, ARM etc. Students can understand Various peripheral devices, memory modules and their interfacing to design a digital systems,smart devices ,gadgets etc.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

1. Term work + Assignments – 10 marks
2. Quiz – 5 Marks
3. Presentation + Reports – 5 Marks

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage
1.	**Microprocessor and Its Architecture :** Internal Architecture,Introduction to Real and Protected mode memory addressing,Memory paging mechanism	06	8%
2.	**Addressing Modes and Instructions :** Program memory addressing mode, data addressing mode, stack memory addressing mode ,Data movement instructions,Arithmetic and Logical instructions,Program control instructions, Programming based on Instructions	08	12%
3.	**8086/8088 Hardware specifications :** Pin details, functions,Clock generator (8284A),Buffering and latching, bus timing, ready & wait state,Mode of operation minimum & maximum mode	06	8%
4.	**Memory and its interfacing :** Devices, address decoding, Interfacing with 8-bit (8088), 16 bit (8086, 80186,80286), 32-bit,(80386DX, 80486),Pentium and Pentium pro	06	15%

	interfacing		
5.	**Basic I/O Interfacing:** Introduction to I/O interfacing and decoding,Programmable Peripheral Interface (8255),Programmable Interval Timer (8254)ADC & DAC	06	15%
6.	**I/O accessing Mechanism:** Polling method,Interrupts,Basic Interrupts,Hardware interrupts, software interrupts, Programmable interrupt controller (8259),DMA, Basic of DMA operation,DMA controller	08	14%
7.	**80186, 80286, 80386 and 80486 Microprocessor:** Enhancement of 8086 in 80186, 80286,Moving to protected mode, Virtual mode Privilege mode and descriptor introduction	06	8%
8.	**Pentium and Pentium Pro Microprocessor :** Introduction and enhancement in Pentium processor Protected mode, virtual mode, paging, Memory management mode, Introduction to Pentium processor.	06	8%
9.	**Introduction to ARM :** RISC & CISC Architecture, Overview of ARM processor, The Acorn RISC Machine, Architectural inheritance, The ARM programmer's model	08	12%
	Total hours	60 hours	100

Reference Books:

1. Barry B. Brey , "*The Intel Microprocessor - 8086/8088,80186,80286, 80386,80486, Pentium processor*", 7th edition, Printice Hall of India (PHI),2006.
2. Nilesh Bahadure,"*Microprocessors The 8086/8088,80186, 80286,80386,80486 and Pentium family*",1st Edition,PHI,2010
3. Douglas V. Hall, "*Microprocessor and interfacing, programming & hardware*", 2nd Edition ,McGraw Hill
4. Peter Able, "*IBM PC Assembly Language Programming*" ,5th Edi.,PHI,2015
5. Mathivanan,"*Microprocessors, PC hardware and interfacing*",Paper back Edi., PHI ,2003
6. Steve Furber, "*ARM – System-On-Chip architecture*",2nd Edi.,PHI ,2012
7. *LyLa B. Das "Embedded Systems: An Integrated Approach"* Pearson Education India.

Course Outcomes (COs):

At the end of this course students will be able to....

1. Understand the architecture of 8086 16-bit Microprocessor
2. Describe the importance and function of each pin of 8086 Microprocessor
3. Write, Debug and Simulate assembly language program
4. Interface Memory, Input/output devices with Advanced Microprocessor

5. Describe the architecture of 80286 and Pentium Microprocessor
6. Recognize the concept of privilege modes and descriptors.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) '-': Not correlated The last row entry is the average of all COs for that PO/PSO. It shows the overall correlation of this course to each of the POs / PSOs.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	2	1	1	-	-	-	-	-	3	1	2	3
CO.2	3	1	2	1	1	1	-	-	-	-	-	1	2	1	1
CO.3	3	3	3	3	3	2	-	-	2	-	-	3	3	3	3
CO.4	3	3	3	3	2	2	-	-	-	-	-	3	3	3	3
CO.*5*	3	2	3	2	1	1	-	-	-	-	-	1	1	1	1
CO.*6*	3	2	2	2	1	1	-	-	-	-	-	2	2	2	1

Delivery Methods:

1. Lectures
2. AV presentations/ PPT presentation
3. TASM/MASM Software

Discussions **Constituent COs in Assessment Tools:**

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentations,Experiments**
2.	CO.2	**Exam,Assignments,Experiments**
3.	*CO.3*	**Exam,Assignments,Presentations,Experiments**
4.	CO.4	**Exam,Assignments,Presentations,Experiments**
5.	CO.*5*	**Exam,Assignments,Presentations,Experiments**
6.	CO.*6*	**Exam,Assignments,Presentations,Experiments**

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EC 306 : Design Engineering

CREDITS - 2 ($L=L_0, T=T_0, P=P_2$)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective:

The course aims to expose students to the basic process and framework of Design Thinking and relevant tools & techniques for Creativity & Innovation,by translating concepts into exercises.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_0	T_0	P_2	C_2	ESE_{00}	CE_{00}	ESE_{30}	CE_{20}	$Total_{50}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Canvases	Report / Questions & Answers

Course Contents :

Unit. No.	Topics	Teaching Hrs.	Weightage %
1.	**Introduction To Design thinking Method:** Design thinking methodology,its importance, innovation by design thinking,relevance of design & design thinking in engineering,Problem identification & problem solving approaches, Domain/user selection (General topic/Products),Team preparation, record book importance & preparation.	05	20

2.	**Empathization Phase :** Field observation through AEIOU Framework; define problem, Ethnographic tools & its usage, Understanding of user contexts, Record book exercise, data analysis using mind mapping tool/Canvas,Preparation of empathy map.	05	20
3.	**Define Phase :** Problem definition by secondary search\prior art search activities, diachronic & synchronic analysis,Problem verification through users\stakeholders.	05	15
4.	**Ideation phase :** Preparation,Refinement of ideation canvas,Brainstorming(What,Why,How,When,For whom),discuss situation/context/location ,discuss props/tools/equipment, Idea Combination through opportunity mapping(taking feedbacks from other teams,faculty guide,users,) ,prioritizing & finalizing idea	05	15
5.	**Product development phase :** Prepare & dicscuss Product development canvas (PDC), Sketching of mock concepts in log book ,SCAMPER tool	05	15
6.	**Proof of concept :** Dirty mock-ups /Fast prototype (made up of paper, card board, thermocol etc.), feedback & final report .	05	15
	Total Hrs.	**30**	

List of References:

1. Karl T. Ulrich and Steven D. Eppinger, "*Product Design and Development*",4th Editon,TMH,2007
2. Tony Ward and James Angus,"*Electronic Product Design*",2nd edition,CRC Press,1999

Course Outcomes (COs
By learning this course students will be able to …

1. Understand Design thinking Process,Problem identification ,Domain/User selection.
2. Identify Unarticulated/Unmet needs of User/Domain through Field work.
3. Define & Verify User /domain based problem through prior art search & users.
4. Prepare& Refine Different canvases through ideas,Solutions & customer feedbacks.
5. Design & define product features,functions,componens,rough sketch etc.
6. Design rough Prototype/Model of product /problem.

Course Articulation Matrix:
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':****Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	2	3	1	2	1	3	1	2	3	1	2	2	1	2	1
CO.2	1	3	1	3	1	2	2	2	3	1	1	2	1	1	1
CO.3	1	3	1	2	2	2	1	1	2	1	1	3	2	3	2
CO.4	1	2	3	2	2	2	1	2	3	1	2	2	1	1	1
CO.*5*	3	2	2	2	3	2	2	1	1	2	2	2	2	2	2
CO.*6*	2	1	2	2	2	3	2	2	2	1	2	2	2	2	2

Delivery Methods:

Laboratory through field visit ,slides, videos,case studies ,canvas,scamper tool, prototypingetc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Field Visit,Presentation,Labs,Exam**
2.	CO.2	**Field Visit ,Presentation,Labs,Exam**
3.	*CO.3*	**Field Visit ,Presentation,Labs,Exam**

4.	CO.4	**Field Visit ,Labs,Exam**
5.	CO.5	**Field Visit ,Labs,Exam**
6.	CO.6	**Field Visit ,Labs,Exam**

EC 307: Digital Communication

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

3rd **Year, B. Tech. (*Electronics and Communication*)**

Course Objective:

To develop the concept of digital data transmission, probability &information theory,error correcting codes, types of digital modulation & BER of various digital demodulation technique.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	**Viva [10]**
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	**Topics**	**Teaching Hours**	**Weightage (%)**

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Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Sampling & Analog to Digital Modulation technique:** Introduction, Sampling theorem, Signal reconstruction, Aliasing, Applications of sampling theorem, Quantization, Compander, Types of analog to digital modulation technique – Pulse code modulation, Differential pulse code modulation, Adaptive DPCM, Delta modulation, Adaptive delta modulation.	09	18
2.	**Principles of digital data transmission:** Digital Communication system, Line coding technique and its properties, PSD of various line coding technique, Pulse shaping, ISI and its effect, Nyquist's first criteria for zero ISI, Scrambling, Regenerative Repeater, Zero forcing equalizer, Timing extraction, Eye diagram.	09	17
3.	**Fundamentals of Probability Theory and Random Variable:** Concept of probability, Conditional probability and independent events, Bayes' theorem, random variable, types of random variable, CDF, PDF, Mean, Variance, Various Distribution functions – Bernoulli, Binomial, Poisson, Uniform, Gaussian, Rayleigh, Chebyshev's inequality, Central limit theorem.	12	18
4.	**Introduction to Information Theory:** Measure of information, Entropy, Source encoding – Huffman code, Channel capacity of discrete memory less channel, Channel capacity of continuous channel, Channel capacity of band-limited AWGN channel and infinite bandwidth channel.	10	14
5.	**Error correcting codes:** Comparison of block codes and Convolutional codes, Hamming bound Linear block code-Encoding and Decoding, Cyclic code-Encoding and Decoding, Convolutional Codes – Code tree, state diagram, trellis diagram, Maximum likelihood decoding, Sequential decoding.	09	15

Unit No.	Topics	Teaching Hours	Weightage (%)
6.	**Digital Modulation & Demodulation technique:** BPSK transmitter, Coherent detection - BPSK receiver and its BER, QPSK transmitter, QPSK receiver and its BER, BER of M-ary PSK technique, M-ary QAM technique and its BER, BFSK transmitter, Coherent detection – BFSK receiver and its BER, MSK transmitter, receiver and its BER, GMSK transmitter, receiver and its BER, Comparison of BER of coherent detection technique.	11	18
	Total Hours	60	100

List of References:

1. B.P. Lathi, Zhi Ding, *"Modern Digital &Analog Communication Systems"*,Oxford University Press, 4th Edition, 2010.
2. Simon Haykin, *"Digital Communication Systems"*, Wiley Publication, 2nd Edition, 2014.
3. John G. Proakis,MasoudSalehi "*Digital Communications*", McGraw Hill Higher Education, 5th Edition, 2008.
4. Bernard Sklar, *"Digital Communications — Fundamentals and Applications"*, Pearson Education, 2nd Edition, 2009.

Course Outcomes (COs):

By learning this course students will be able to …

7. Convert analog signal into digital signal using various modulation technique.
8. Design the PSD of various line coding technique.
9. Compare& calculate the Mean, Variance, PDF& CDF of various distribution functions.
10. Measure channel capacity of discrete and continuous channel.
11. Create and modify the codeword of various error corrections coding technique.
12. Generate various digital modulation signals and compare& sketch the BER of it.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	1	1	3	1	-	1	1	1	3	3	3	2
CO.2	3	3	3	2	2	2	1	1	3	2	2	3	1	2	2
CO.3	3	3	2	2	2	2	1	-	2	2	1	3	1	2	1
CO.4	3	3	2	2	2	3	1	1	2	2	2	3	2	2	1
CO.5	3	3	2	2	2	3	-	2	3	3	2	3	1	2	2

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.6	3	2	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	3	2.67	2.17	1.83	1.83	2.67	0.83	1.0	2.33	2.17	1.67	3	1.83	2.17	1.83

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Part I:Performance of Experiments Using Digital Communication Trainer kits, Function Generator, Cathode Ray Oscilloscope, Digital Storage Oscilloscope, Digital Multimeter, Regulated dc power Supply etc.

3. Laboratory: Part II: Using MATLAB Software, sketch & compare the BER v/s SNR for all digital demodulation technique and also plot the PSD of various line coding technique.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam,Assignments, Presentation,Experiments**
2.	CO.2	**Exam,Assignments, Presentation,Experiments**
3.	*CO.3*	**Exam, Assignments, Presentation,Experiments**
4.	CO.4	**Exam,Assignments, Presentation,Experiments**
5.	CO.5	**Exam,Assignment,Presentation,Experiments**
6.	CO.6	**Exam,Assignments, Presentation,Experiments**

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EC 308: Antenna and Wave Propagation

CREDITS - 6 (L=L_4, T=T_0,P=P_2)

3rd Year, B.Tech. (*Electronics and Communication*)

Course Objective:
Knowledge of Electromagnetics wave propagation in different medium is essential for the Communication Engineers. As antenna is vital part of any communication system and its knowledge is equally important as well.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1.	**Transmission Line:** Transmission line equations and solutions, determination of line parameters, transmission coefficient and reflection coefficient,standing wave and standing wave ratio, line impedance and admittance, short circuit line, line terminated by arbitrary load, transmission line matching, single stub matching, application of smith chart in finding transmission line parameters and solve the transmission line matching problems. Bounce diagram, time domain reflectometry.	09	15

Unit No.	Topics	Teaching Hours	Weightage %
2.	**Plane EM Wave Propagation:** Wave Propagation in Free Space, Second order differential equation and its solution for plane EM wave in free space, Plane EM wave propagation in lossy and lossless Dielectrics and in Good Conductors, Skin Effect,Reflection of Plane Wave, Transmission and reflection coefficient, Standing Wave Ratio, Poynting Vector, Wave Power, Polarization.	08	15
3.	**Antenna Fundamentals:** Definition and functions of an antenna, all antenna types (antenna family), Comparison between transmission from an antenna & through transmission line, radiation patterns of antennas-field and power patterns, beam area, beam width-Half-Power Beam width (HPBW) and First Null Beam width (FNBW), Radiation Intensity, Beam Efficiency, Directivity and directive gain, radiation resistance, radiation efficiency, resolution, Antenna aperture-physical and effective apertures, effective height.	06	20
4.	**Wire Antennas and Array:** Dipole antennas: Radiation from Hertzian dipole, half wave dipoles and quarter wave monopole and its radiation resistances, Antenna arrays, Expression for electric fields from two and N element arrays, Linear arrays - Broad-side array and End-Fire array, Method of pattern multiplication, Binomial array .	10	10
5.	**Practical Antennas:** Folded dipole, Yagi-Uda antenna, log periodic antenna, helical antenna, rhombic antenna, field patterns and radiation resistance of circular loop antenna.	09	15
6.	**Micro Strip Antennas:** Rectangular and circular types-function, features analysis, design considerations and applications.	06	15
7.	**Wave Propagation:** Radio wave propagation, Ground or Surface Wave Propagation, Sky wave propagation, Space wave propagation, Effect of earth curvature on space wave, multi path reception in space wave. Structure of troposphere and ionosphere, Characteristic of Ionospheric layers, Definitions for Virtual height, MUF and Skip distance, Fading, Ionospheric absorptions, Multi-hop propagation	08	10
	Total Hours	56	100 %

List of References:

1. Nannapaneni Narayana Rao, "*Elements of Engineering Electromagnetics*",Sixth Edition Pearson Education, 2004
2. J.D. Krauss, "*Antennas for all applications*",Fourth Edition,TMH publication, 2010
3. Jordan & Balmain, "*Electromagnetic wave & radiating systems*",Second edition, Prentice-Hall, 1968.
4. C. Balanis, "*Antenna Theory: Analysis and design*", Third Edition, Wiley India, 2005.
5. K.D. Prasad,"*Antenna & Wave Propagation*",Satyaprakash Publications.

Course Outcomes (COs):

By learning this course students will be able to …

1. Design, finding fault on, make matching of transmission line.
2. Understand the importance of EM waves in communication and its behavior in free space and material medium.
3. Identify different types of antennas, radiation through antenna, measure antenna parameters.
4. Design and analyze matching and feeding networks for antennas.
5. Design and analyze antennas using Simulation software.
6. Identify the characteristics of radio wave propagation.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO .1	3	3	2	1	2	2	2	2	2	3	-	2	1	1	2
CO .2	2	3	2	2	1	2	2	3	1	3	-	1	1	1	2
CO.3	3	2	2	1	3	2	2	2	2	2	-	2	1	1	2
CO.4	2	2	1	2	2	2	2	3	2	2	-	2	1	1	2
CO.5	3	3	3	3	2	2	2	2	3	2	-	3	2	1	1
CO.6	1	2	1	2	1	2	2	3	1	2	-	1	1	1	2
Average	2.33	2.5	1.83	1.83	1.83	2	2	2.5	1.83	2.33	-	1.83	1.16	1	1.83

Delivery Methods:

3. Lectures through Blackboard/ power-point slides.
4. Laboratory: Performance of Experiments Using Antenna Trainer kits, RF Generator and RF Detector, Oscilloscope and HFSS software tool etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO .1	**Exam,Assignments,Presentations, Experiments.**
2.	CO .2	**Exam,Assignments,Experiments.**
3.	CO.3	**Exam,Assignments,Presentations,Experiments.**
4.	CO.4	**Exam,Assignments,Experiments.**
5.	CO.5	**Exam,Assignments, Tutorial. Experiments.**
6.	CO.6	**Exam,Assignments,Experiments.**

List of Experiments

This shall consist of atleast 10 Practical's based on trainer kits & software.

Sr No	Experiment Title
1.	To study various antennas, its application and tentative radiation pattern.(study experiment)
2.	To study and observe the radiation patter of strait dipole antenna.
3.	To study and compare the radiation patter of folded dipole with straight dipole antenna and comment on the radiation resistance and it's matching with free space.
4.	To study and compare the radiation pattern of 3-element and 5-element Yagi and give your comment on effect of addition of parasitic elements to the given antenna.
5.	To study the variation of radiated field with distance from transmitting antenna.
6.	To study and plot the radiation pattern of the helical antenna.
7.	To study Phenomena of Linear and Circular Polarization of antennas and from that state the importance of orientation of antenna. What inference do you draw from this experiment?
8.	To study and plot the radiation pattern of the Log-Periodic antenna and observe its frequency independency.
9.	To study and compare the radiation patter of End-fire array and Broad-side array.
10.	To study and observe the radiation pattern of the horn antenna.
11.	Introduction to HFSS (High Frequency Simulation Software).
12.	Micro Strip antenna design and simulation using HFSS.

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EC 309: Embedded Systems
CREDITS - 6 (L=L_4, T=T_0, P=P_2)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective:

To understand and learn the different design metrics of embedded system with real time operating system concepts.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Lab work [10]
File	Attendance/ lab work/viva

Course Content:

Unit. No.	Content	Teaching Hr.	Weightage
1.	**Introduction to Embedded System :** Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Introduction to Real Time Embedded system and general purpose computers, Embedded system components, Embedded System Design Process, Classification of an embedded system, Examples of an embedded system, Major Application areas	6	10%
2.	**ARM instruction set and Assembly programming :** Data processing instructions, Data transfer instructions, Control flow instructions, Conditional execution,ARM Condition codes, Software interrupt (SWI), Multiply instructions, Writing simple assembly language programs for ARM, 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, Understanding of ARM instruction execution, Exceptions in ARM, Thumb	10	20%

	programmer's model and instruction set		
3.	**C Programming for ARM :** C programs for General purpose I/O, general purpose timer, PWM Modulator, UART, ADC, DAC	**10**	**15%**
4.	**Communication Bus protocols for embedded system :** UART and SPI communication protocol, I2C communication protocol, USB communication protocol, PCI-bus communication protocol, CAN protocol	**10**	**15%**
5.	**Inter-process Communication and Synchronization of processes, Threads and Tasks :** Multiple process in an application, Multiple Threads in an application, Task and Task state, Task and Data, Clear-cut Distinction between Functions, ISRS and Tasks by their Characteristics, Concept of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions	**12**	**20%**
6.	**Real Time Operating System :** Operating system service, Process management, Timer function, Event function, Memory management, Device , File and I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt Sources calls, Real Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues	**12**	**20%**
	Total	**60**	**100**

List of References:

1. Raj Kamal, "*Embedded Systems – Architecture, Programming and Design*", 2nd edition, McGraw Hill,2009
2. Wayne Wolf, *Computers as Components, Principles of Embedded Computing Systems Design*, 2nd Edition, Elsevier, 2008
3. K.V. Shibu, "*Introduction to Embedded Systems*"1st edition, McGraw Hill Education,2009
4. Christopher Hallinan, "*Embedded Linux Primer -A Practical, Real-World Approach*", 2nd edition, Prentice Hall,2006

Course Outcomes (Cos) :

At the end of this course students will be able to

1. Understand the fundamental concepts of Embedded Systems.
2. Understand the features and structures of practical Operating System implementations.
3. Acquire practical knowledge of Embedded System with Real Time Operating Systems.
4. Understand the use of multitasking techniques in Real Time Systems.
5. Analyze the system safety and their impact on real-time embedded system design
6. Gain Knowledge for selecting tools and techniques in real time embedded system design.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
1	3	1	1	1	2	1	1	-	2	-	-	2	3	2	3
2	3	1	1	1	2	2	2	-	1	-	-	2	2	1	2
3	2	3	1	1	3	1	2	-	1	-	-	2	3	2	3
4	3	1	2	1	2	2	1	-	2	-	-	-	2	1	2
5	3	2	1	1	3	1	2	-	1	-	-	2	1	1	3
6	2	1	2	1	2	1	1	-	1	-	-	2	1	1	3
AVG.	2.67	1.5	1.33	1	2.33	1.33			1.33			2	2	1.33	2.67

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Embedded system kits

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1	CO.1	Exam,Assignments, Presentation,Experiments
2	CO.2	Exam,Assignments, Presentation,Experiments
3	CO.3	Exam,Assignments, Presentation,Experiments
4	CO.4	Exam,Assignments, Presentation,Experiments
5	CO.5	Exam,Assignments,Presentation,Experiments
6	CO.6	Exam,Assignments, Presentation,Experiments

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EC 310: Scripting Languages
CREDITS - 3 (L=L_0, T=T_1, P=P_2)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective:

To familiarize students with the Linux environment with basic command and to learn the fundamentals of shell scripting/programming.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_0	T_0	P_2	C_2	ESE_0	CE_0	ESE_{30}	CE_{20}	$Total_{50}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Labwork [10]
File	Attendance/ lab work/viva

Course Content:

Unit. No.	Content	Teaching Hrs.	Weightage %
1.	**Linux Basics** : Introduction to Linux, File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, Searching a file & directory, zipping and unzipping concepts	8	25
2.	**Linux Networking** : Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.	8	25
3.	**Perl Scripting** : Introduction to Perl Scripting, working with Simple Values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in	9	25

	Perl Scripting, References &Subroutines, Running and Debugging Perl, Modules, Object-Oriented Perl.		
4	**Python Scripting :** Introduction to Python, Using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.	**9**	**25**
	Total	**34**	**100 %**

List of References:

5. Andrew Mallet, "*Mastering Linux Shell Scripting*" 1st Edition, Packet Publishing, December 2015
6. Randal L. Schwartz, Brian D. Foy, Tom Phoenix, "*Learning Perl*",6th edition, O'Reilly, July 2011
7. John Paul Mueller, "*Beginning Programming with Python for Dummies*" Paperback, John Wiley & Sons, October 2014.

Course Outcomes (Cos):

At the end of this course students will be able to

1. Understand the working environment of LINUX OS including its file system.
2. Identify and Use LINUX utilities for file processing operations with appropriate security.
3. Interpret utilities including file management with wild card in LINUX environment.
4. Use of shell features for constructing and running jobs.
5. Design, develop, debug & execute shell script.
6. Use of regular expression with pattern matching utilities in script.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
1	3	1	1	1	2	1	-	-	2	-	-	2	3	2	3
2	3	1	1	1	2	2	-	-	1	-	-	2	2	1	2
3	2	3	1	1	3	1	-	-	1	-	-	2	3	2	3
4	3	1	2	1	2	2	-	-	2	-	-	-	2	1	2
5	3	2	1	1	3	1	-	-	1	-	-	2	1	1	3
6	2	1	2	1	2	1	-	-	1	-	-	2	1	1	3
AVG.	2.67	1.5	1.33	1	2.33	1.33			1.33			2	2	1.33	2.67

Delivery Methods:

1. Laboratory exercises using Linux Operating System, Perl and Python.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO .1	Exam,Assignments, Presentation,Experiments
2	CO .2	Exam,Assignments, Presentation,Experiments
3	CO.3	Exam,Assignments, Presentation,Experiments
4	CO.4	Exam,Assignments, Presentation,Experiments
5	CO.5	Exam,Assignments,Presentation,Experiments
6	CO.6	Exam,Assignments, Presentation,Experiments

EC 351: TELECOM AND SWITCHING

CREDITS - 5 (L=*3*, T=*0*, P=*2*)

***3rd Year*, B. Tech. (*Electronics and Communication*)**

Course Objective:

To providefundamental of Modern digital telecommunication switching and networks like PSTN, PDN and ISDN, voice data integration and importance of telephone traffic analysis.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations/Technical Visit Report	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Switching Systems:** Evolution of Telecommunications; Basics of a Switching System; Functions of a Switching System; Crossbar Switching-Principle of Crossbar Switching; Crossbar Switch Configurations; Cross-Point Technology; Crossbar Exchange Organization; A General Trucking; Electronic Switching; Digital Switching Systems. Telecommunications Traffic: Introduction; The Unit of Traffic; Congestion; Traffic Measurement; A Mathematical Model; Lost-Call Systems-Theory; Traffic Performance; Loss Systems in Tandem; Use of Traffic Tables; Queuing Systems-The Second Erlang Distribution; Probability of Delay; Finite Queue Capacity; Some Other Useful Results; Systems with a Single Server; Queues in Tandem; Delay Tables; Applications of Delay Formula.	08	15
2.	**Switching Networks:** Single Stage Networks; Grading-Principle; Two Stage Networks; Three Stage Networks; Four Stage Networks Time Division Switching: Basic Time Division Space Switching; Basic Time Division Time Switching; Time Multiplexed Space Switching; Time Multiplexed Time Switching; Combination Switching; Three Stage Combination Switching. Control of Switching Systems: Call Processing Functions-Sequence of Operations; Signal Exchanges; State Transition Diagrams; Common Control; Reliability; Availability and Security; Stored Program Control	10	15
3.	**Traffic Engineering:** Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.	07	20

Unit No.	Topics	Teaching Hours	% Weightage
4.	**Signaling:** Introduction; Customer Line Signaling; Audio Frequency Junctions and Trunk Circuits; FDM Carrier Systems-Out band Signaling; in band (VF) Signaling; PCM Signaling; Inter Register Signaling; Common Channel Signaling, Principles-General Signaling Networks; Signaling System Number, Signaling System Number 7; The High Level Data Link Control Protocol; Signal Units.	05	20
5.	**Data networks:** Block Diagram, features, working of EPABX Systems, Data transmission in PSTNs, Data Rates in PSTNs, Modems, Switching Techniques for data Transmission, Circuit Switching, Store and Forward Switching Data communication Architecture, ISO-OSI Reference Model, Satellite based data networks, LAN, Metropolitan Area network, Fiber optic networks, and Data network standards.	10	15
6.	**Integrated Services Digital Networks:** Motivation for ISDN, New services, Network and Protocol architecture, Transmission Channels, User Network Interface, signaling, Numbering and Addressing, Service characterization, Interworking ,ISDN standards, Broadband ISDN ,Voice data Integration(VoIP).	10	15
	Total Hours.	50	100

List of References:

1. J. E Flood, *"Telecommunications Switching and Traffic Networks"* Pearson Education, 1st Edition, 2007.
2. Tyagarajan Viswanathan, *"Telecommunications Switching Systems and Networks"* Prentice Hall of India Pvt. Ltd., Printing Edition,2006.
3. John C Bellamy, "*Digital Telephony*". John Wiley International,3rd Edition, 2000.

Course Outcomes (COs):

On completion of this course, it is expected that the student will be able to:

1. Understand the main concepts of telecommunication network design
2. Analyze and evaluate fundamental telecommunication traffic models.

3. Understand basic modern signaling system.
4. Solve traditional interconnection switching system design problems.
5. Understand concept of traffic engineering.
6. To compare telephone network, data network and integrated service digital network

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO .1	3	2	3	2	1	2	-	-	-	-	1	2	3	2	-
CO .2	3	2	3	2	1	-	-	-	-	-	1	2	3	2	1
CO.3	3	2	3	2	3	-	-	-	-	-	1	2	3	2	2
CO.4	3	2	3	2	1	-	-	-	2	-	-	2	3	2	2
CO.5	3	1	3	2	1	2	-	1	-	-	2	2	3	1	-
CO.6	3	3	3	3	3	-	-	-	-	-	1	2	3	2	3

Delivery Methods:

1. Lectures through Blackboard/ Power-Point Slides, Videos, Pictures.
2. Laboratory: Performance of Experiments Using EPBAX Trainer kits, Function Generator, Oscilloscope, Digital Multimeter, Power Supply, etc.
3. Industrial visit :

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO .1	**Exam,Assignments, Presentation,Experiments**
2.	CO .2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Industrial Visit, Exam, Assignments, Presentation**
5.	CO.5	**Exam,Assignment,Presentation,Experiments**
6.	CO.6	**Industrial Visit, Exam, Assignments, Presentation**

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EC 351: TELECOM AND SWITCHING

CREDITS - 5 (L=*3*, T=*0*, P=*2*)

***3rd Year*, B. Tech. (*Electronics and Communication*)**

Course Objective:

To providefundamental of Modern digital telecommunication switching and networks like PSTN, PDN and ISDN, voice data integration and importance of telephone traffic analysis.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of AssessmentInstruments under CE Practical Component:

Term work [10]	**Viva [10]**
Attendance/Lab File /Presentations/Technical Visit Report	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	**Topics**	**Teaching Hours**	**% Weightage**

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Unit No.	Topics	Teaching Hours	% Weightage
1.	**Switching Systems:** Evolution of Telecommunications; Basics of a Switching System; Functions of a Switching System; Crossbar Switching-Principle of Crossbar Switching; Crossbar Switch Configurations; Cross-Point Technology; Crossbar Exchange Organization; A General Trucking; Electronic Switching; Digital Switching Systems. Telecommunications Traffic: Introduction; The Unit of Traffic; Congestion; Traffic Measurement; A Mathematical Model; Lost-Call Systems-Theory; Traffic Performance; Loss Systems in Tandem; Use of Traffic Tables; Queuing Systems-The Second Erlang Distribution; Probability of Delay; Finite Queue Capacity; Some Other Useful Results; Systems with a Single Server; Queues in Tandem; Delay Tables; Applications of Delay Formula.	08	15
2.	**Switching Networks:** Single Stage Networks; Grading-Principle; Two Stage Networks; Three Stage Networks; Four Stage Networks Time Division Switching: Basic Time Division Space Switching; Basic Time Division Time Switching; Time Multiplexed Space Switching; Time Multiplexed Time Switching; Combination Switching; Three Stage Combination Switching. Control of Switching Systems: Call Processing Functions-Sequence of Operations; Signal Exchanges; State Transition Diagrams; Common Control; Reliability; Availability and Security; Stored Program Control	10	15
3.	**Traffic Engineering:** Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.	07	20

Unit No.	Topics	Teaching Hours	% Weightage
4.	**Signaling:** Introduction; Customer Line Signaling; Audio Frequency Junctions and Trunk Circuits; FDM Carrier Systems-Out band Signaling; in band (VF) Signaling; PCM Signaling; Inter Register Signaling; Common Channel Signaling, Principles-General Signaling Networks; Signaling System Number, Signaling System Number 7; The High Level Data Link Control Protocol; Signal Units.	05	20
5.	**Data networks:** Block Diagram, features, working of EPABX Systems, Data transmission in PSTNs, Data Rates in PSTNs, Modems, Switching Techniques for data Transmission, Circuit Switching, Store and Forward Switching Data communication Architecture, ISO-OSI Reference Model, Satellite based data networks, LAN, Metropolitan Area network, Fiber optic networks, and Data network standards.	10	15
6.	**Integrated Services Digital Networks:** Motivation for ISDN, New services, Network and Protocol architecture, Transmission Channels, User Network Interface, signaling, Numbering and Addressing, Service characterization, Interworking ,ISDN standards, Broadband ISDN ,Voice data Integration(VoIP).	10	15
	Total Hours.	50	100

List of References:

4. J. E Flood, *"Telecommunications Switching and Traffic Networks"* Pearson Education, 1st Edition, 2007.
5. Tyagarajan Viswanathan, *"Telecommunications Switching Systems and Networks"* Prentice Hall of India Pvt. Ltd., Printing Edition,2006.
6. John C Bellamy, "*Digital Telephony*". John Wiley International,3rd Edition, 2000.

Course Outcomes (COs):

On completion of this course, it is expected that the student will be able to:

7. Understand the main concepts of telecommunication network design
8. Analyze and evaluate fundamental telecommunication traffic models.

9. Understand basic modern signaling system.
10. Solve traditional interconnection switching system design problems.
11. Understand concept of traffic engineering.
12. To compare telephone network, data network and integrated service digital network

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO .1	3	2	3	2	1	2	-	-	-	-	1	2	3	2	-
CO .2	3	2	3	2	1	-	-	-	-	-	1	2	3	2	1
CO.3	3	2	3	2	3	-	-	-	-	-	1	2	3	2	2
CO.4	3	2	3	2	1	-	-	-	2	-	-	2	3	2	2
CO.5	3	1	3	2	1	2	-	1	-	-	2	2	3	1	-
CO.6	3	3	3	3	3	-	-	-	-	-	1	2	3	2	3
Avg.	3	2	3	2.16	1.66	0.66	-	0.08	0.16	-	0.5	2	3	1.83	0.66

Delivery Methods:

4. Lectures through Blackboard/ Power-Point Slides, Videos, Pictures.
5. Laboratory: Performance of Experiments Using EPBAX Trainer kits, Function Generator, Oscilloscope, Digital Multimeter, Power Supply, etc.
6. Industrial visit :

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO .1	**Exam,Assignments, Presentation,Experiments**
2.	CO .2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Industrial Visit, Exam, Assignments, Presentation**
5.	CO.5	**Exam,Assignment,Presentation,Experiments**
6.	CO.6	**Industrial Visit, Exam, Assignments, Presentation**

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EC 352 : Industrial Automation (PE-1)

CREDITS - 5 (L=3, T=*0*,P=2)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective: The students will learn basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide opportunity to learn industrial automation techniques.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$TOTAL_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations/Quiz	Experiment Performance/ Questions & Answers

Course Contents:

Topic No	Topics	Teaching Hours	Weightage %
1.	**Introduction:** Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus & profibus	6	15%
2.	**Automation components:** Sensors for flow, humidity and pH measurement. Actuators, process control valves. Introduction of DC and AC servo drives for motion control.	5	10%
3.	**Computer aided measurement and control systems:** Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process	8	15%

	related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.		
4.	**Programmable logic controllers:** Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.	8	15%
5.	**PLC Programming:** I/O processing, Ladder and functional block programming, IL, SFC and ST programming methods, Internal relays, Jump and call, Timers, Counters.	12	20%
6.	**Distributed Control System:** Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS	6	15%
7.	**Overview of Industrial automation using robots:** Basic construction and configuration of robot, pick and place robot, Welding robot.	5	10%
	Total	50	100%

Reference Books:

1. S.K. Singh,"*Industrial Instrumentation and Control*",The McGraw Hill Companies,3rd Edition, 1980.
2. C.D. Johnson,"*Process Control Instrumentation Technology*" , PHI,8th Edition, 2006
3. W. Bolton,"*Programmable Logic Controllers*" ,Newnes publications,4th Edition,2003
4. Parr, Newnem"*Industrial control handbook*",Industry Press, 3rd Edition, 1999.
5. Dunning, Delmar"*Programmable logic controller*",Thomson/Delmar Learning, 3rd Edition, 2005

Course Outcome:

After learning the course the students should be able to:

1. Learn various automation components and systems
2. Design and Draw block diagram of industrial automation and control system
3. Analyze architecture of industrial automation system
4. Measure industrial parameters for automation
5. Design and program programmable logic controllers for industrial automation
6. To study Industrial Robotics for automation

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO .1	3	1	1	1	1	2	3	3	1	2	1	2	1	1	1
CO .2	3	2	3	2	3	2	3	3	2	2	1	1	3	1	3
CO.3	3	3	2	3	3	2	3	2	2	2	2	1	3	3	2
CO.4	3	3	2	2	3	2	2	2	2	2	1	1	2	2	2
CO.5	3	3	3	3	3	2	2	2	2	2	2	1	3	3	3
CO.6	3	2	1	1	3	2	2	3	1	3	1	2	2	1	2

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using PLC Trainer kits, Bread board, Active & Passive Components, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO .1	**Exam,Assignments, Presentation,Experiments,Quiz**
2.	CO .2	**Exam,Assignments, Presentation,Experiments,Quiz**
3.	CO.3	**Exam,Assignments, Presentation,Experiments,Quiz**
4.	CO.4	**Exam,Assignments, Presentation,Experiments, Industry Visit**
5.	CO.5	**Exam,Assignment,Presentation,Experiments, Industry Visit**
6.	CO.6	**Exam,Assignments, Presentation,Experiments, Quiz**

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EC 353: Digital Systems Design Using VHDL

CREDITS - (L=4, T=*0*, P=*2*)

3rd Year, B.TECH (Electronics & Communication)

Course Objective:

This course intends to provide the strong foundation of the design of digital systems using a hardware description language, VHDL.The students will have design practice sessions and implementing digital logic systems with electronic design tools.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File-Quiz	Performance-Viva/ Presentations

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Introduction, Code Structure, Data Types, Operators and Attributes :** About VHDL, Design Flow, EDA Tools, Translation of VHDL Code into a Circuit, Design Examples , Fundamental VHDL Units, LIBRARY Declarations, ENTITY, ARCHITECTURE , Introductory Examples, Pre-Defined Data Types User-Defined Data Types , Subtypes, Arrays , Port Array , Records , Signed and Unsigned Data Types , Data Conversion – Examples , Operators, Attributes , User-Defined Attributes , Operator Overloading, GENERIC -Examples	08	17

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Unit No.	Topics	Teaching Hours	% Weightage
2.	**Concurrent Code and Sequential Code :** Concurrent versus Sequential, Using Operators ,WHEN (Simple and Selected) , GENERATE , BLOCK , Examples , PROCESS, Signals and Variables , IF , WAIT ,CASE , LOOP , CASE versus IF , CASE versus WHEN , Bad Clocking, Using Sequential Code to Design Combinational Circuits –Examples,	08	17
3.	**Signals, Variables and State Machine, Additional Circuit Designs :** CONSTANT , SIGNAL , VARIABLE , SIGNAL versus VARIABLE ,Number of Registers , State Machine Introduction , Different Design Style , Encoding Style: From Binary to One Hot –Examples .Barrel Shifter , Signed and Unsigned Comparators, Carry Ripple and Carry Look Ahead Adders , Fixed-Point Division , Vending-Machine Controller Serial Data Receiver , Parallel-to-Serial Converter , Playing with a Seven-Segment Display , Signal Generators , Memory Design – Examples ,	08	17
4.	**Packages, Components, Functions and Procedures:** Introduction, PACKAGE , COMPONENT , PORT MAP , GENERIC MAP , Examples , FUNCTION , Function Location , PROCEDURE , Procedure Location FUNCTION versus PROCEDURE Summary , ASSERT , Examples	08	17
5.	**Additional System Designs :** Serial-Parallel Multiplier , Parallel Multiplier , Multiply-Accumulate Circuits Digital Filters , Neural Networks - Examples ,Test Bench and Verification Features	08	16
6.	**Programmable Logic Devices& Software :** SPLDs (Simple PLDs) , CPLD (Complex PLD) , FPGA , Xilinx ISE Design Suite , Altera Quartus II	08	16

Unit No.	Topics	Teaching Hours	% Weightage
	Total Hrs.	**48**	**100**

Reference Books:

1. Pedroni, Volnei A., *"Circuit design with VHDL"*, MIT press, 2004.
2. P. J. Ashenden, *"The Designer's Guide to VHDL"*, Elsevier Science, 2010.
3. Bhasker J., *"VHDL Primer"*, Englewood Cliffs, NJ: Prentice Hall, 3rd Edition, 1999.
4. Perry D. L., *"VHDL Programming By Example"*, New York: McGraw-Hill, 2nd Edition, 1994.
5. Armstrong J. R. and F. G. Gray, *"VHDL Design Representation and Synthesis"*, Englewood Cliffs, NJ:Prentice Hall, 2nd Edition, 2000.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the code Structure, data Types, operators and attributes of VHDL Programming.
2. Understand the design of Combinational and Sequential Circuits using VHDL.
3. Analyze, understand, and design State Machine based digital applications.
4. Identify requirements for packages, components, functions and procedures.
5. Develop skill to build, and troubleshoot digital circuits through VHDL programming.
6. Simulate and synthesis of extensive designs on PLD, CPLD& FPGA.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO .1	3	3	3	2	1	3	1	1	1	2	2	2	2	2	2
CO .2	3	3	3	3	1	3	1	1	2	2	2	2	2	3	3
CO.3	3	3	3	3	3	3	1	1	2	2	2	2	3	3	3
CO.4	3	3	3	3	2	3	1	1	2	3	2	2	3	3	3
CO.5	3	3	3	3	3	3	1	1	2	2	2	2	3	3	3
CO.6	3	3	3	3	3	3	1	1	3	1	2	2	3	3	3

Delivery Methods:

1. Lectures: through Blackboard, power-point slides, videos, animations, pictures, graphics etc.

2. Laboratory: Performance of Experiments Using Spartan 3A/3AN Trainer Board and Xilinx ISE Design Suite.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO .1	Exam,Assignments, Presentation, Experiments
2.	CO .2	Exam,Assignments, Presentation, Experiments
3.	CO.3	Exam,Assignments, Presentation, Experiments
4.	CO.4	Exam,Assignments, Presentation, Experiments
5.	CO.5	Exam,Assignment,Presentation,Experiments
6.	CO.6	Exam,Assignments, Presentation, Experiments

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Meeting of **BOS** of Electronics & Communication Engineering Branch, BVM (Autonomous),was held at **10:30 AM** on Date: 0**8-04-2017** for the following agenda item.

AGENDA ITEM 2: EC1718.1.2

AGENDA	DISCRIPTION
EC1718.1.2	Amendment in Teaching structure of final level of UG programme (Annexture-II)

Programme Structure (Proposed and Approved) for **Final Level** of UG Programme under BVM (Autonomous) w.e.f Academic Year : 2018-19

Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
2.1	Dr. N.J Kothari , Dr. R.A Thakkar	EC BoS	Shift Microwave Engineering as compulsory (core) subject. Shift Optical Fiber communication or DCN as PE -II subject .
2.2	Dr. N.J Kothari , Dr. R.A Thakkar	EC BoS	Rename Device driver Writing subject name as Device Driver Development .
2.3	Dr. B.C Goradiya	EC BoS	We can Rename Device driver Writing subject name as Device Drivers.

OLD Programme Structure (approved in BoS of EC1617.1) for **Fourth Level** of UG under BVM (Autonomous)

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Sr. No	Code	Course	Teaching Scheme					Evaluation Scheme				
		Semester - VII	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL**
1	PC	Antennas and Microwaves	4	0	2	6	6	30	70	20	30	150
2	PC	Embedded Systems	4	0	2	6	6	30	70	20	30	150
3	PC	Optical Communication	3	0	2	5	5	30	70	20	30	150
3	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5	PE –II	Program Elective – II ASIC Verification Biomedical and Instrumentation	3	0	2	5	5	30	70	20	30	150
6	PE-III	Program Elective – III Image Processing Virtual Instrumentation	3	0	2	5	5	30	70	20	30	150
		TOTAL	**15**	**0**	**16**	**31**	**31**	**150**	**450**	**150**	**150**	**900**
		Semester - VIII										
7	PC	Wireless Communication	4	0	2	6	6	30	70	20	30	150
8	PC	Project - II	0	0	18	18	18	00	200	50	00	250
9	PE	Program Elective – IV Advance Communication Systems Analog VLSI Design	4	0	2	6	6	30	70	20	30	150
		Total	**8**	**0**	**22**	**30**	**30**	**60**	**340**	**90**	**60**	**550**

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Programme Structure Amendment (Proposed & Approved) for **Fourth Level** of UG Programme under BVM (Autonomous) w.e.f Academic Year: 2018-19

Annexture-II

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
			L	T	P	H	C	M	E	I	V	TOTAL
		Semester - VII										
1.	PC	Wireless Communication	3	0	2	5	5	30	70	20	30	150
2.	PC	Data Communication & Networking	4	0	2	6	6	30	70	20	30	150
3.	PC	Optical Fiber Communication	3	0	2	5	5	30	70	20	30	150
4.	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5.	PE	**Programme Elective II**	3	0	2	5	5	30	70	20	30	150
		Microwave Engineering										
		Image Processing										
		Biomedical Instrumentation										
6.	OE	Open Elective -II Embedded Systems and applications	3	0	2	5	5	30	70	20	30	150
		Total	**16**	**0**	**14**	**30**	**30**	**150**	**450**	**150**	**150**	**900**
		Semester - VIII										
1.	PC	Advance Communication system	3	0	2	5	5	30	70	20	30	150
2.	PC	Project – II	0	0	15	15	15	00	200	50	00	250
3.	PE	**Programme Elective – III**	3	0	2	5	5	30	70	20	30	150
		Radar & Navigational Aids										
		Device Driver writing										
		Machine learning										
4.	PE	**Programme Elective – IV**	3	0	2	5	5	30	70	20	30	150
		Virtual Instrumentation										
		Satellite Communication										
		Wireless Sensor Networks										
		Total	**9**	**0**	**21**	**30**	**30**	**90**	**410**	**110**	**90**	**700**

Website: http://bvmengineering.ac.in
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Meeting of **BOS** of Electronics & Communication Engineering Branch, BVM (Autonomous),was held at **10:30 AM** on Date: 0**8-04-2017** for the following agenda item.

AGENDA ITEM 2: EC1718.1.2

AGENDA	DISCRIPTION
EC1718.1.2	Amendment in Teaching structure of final level of UG programme (Annexture-II)

Programme Structure (Proposed and Approved) for **Final Level** of UG Programme under BVM (Autonomous) w.e.f Academic Year : 2018-19

Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
2.1	Dr. N.J Kothari , Dr. R.A Thakkar	EC BoS	Shift Microwave Engineering as compulsory (core) subject. Shift Optical Fiber communication or DCN as PE -II subject .
2.2	Dr. N.J Kothari , Dr. R.A Thakkar	EC BoS	Rename Device driver Writing subject name as Device Driver Development .
2.3	Dr. B.C Goradiya	EC BoS	We can Rename Device driver Writing subject name as Device Drivers.

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OLD Programme Structure (approved in BoS of EC1617.1) for **Fourth Level** of UG under BVM (Autonomous)

Sr. No	Code	Course	Teaching Scheme					Evaluation Scheme				
		Semester - VII	**L**	**T**	**P**	**H**	**C**	**M**	**E**	**I**	**V**	**TOTAL**
1	PC	Antennas and Microwaves	4	0	2	6	6	30	70	20	30	150
2	PC	Embedded Systems	4	0	2	6	6	30	70	20	30	150
3	PC	Optical Communication	3	0	2	5	5	30	70	20	30	150
3	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5	PE –II	Program Elective – II ASIC Verification Biomedical and Instrumentation	3	0	2	5	5	30	70	20	30	150
6	PE-III	Program Elective – III Image Processing Virtual Instrumentation	3	0	2	5	5	30	70	20	30	150
		TOTAL	**15**	**0**	**16**	**31**	**31**	**150**	**450**	**150**	**150**	**900**
		Semester - VIII										
7	PC	Wireless Communication	4	0	2	6	6	30	70	20	30	150
8	PC	Project - II	0	0	18	18	18	00	200	50	00	250
9	PE	Program Elective – IV Advance Communication Systems Analog VLSI Design	4	0	2	6	6	30	70	20	30	150
		Total	**8**	**0**	**22**	**30**	**30**	**60**	**340**	**90**	**60**	**550**

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Programme Structure Amendment (Proposed & Approved) for **Fourth Level** of UG Programme under BVM (Autonomous) w.e.f Academic Year: 2018-19

Annexture-II

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
			L	T	P	H	C	M	E	I	V	TOTAL
		Semester - VII										
1.	PC	Wireless Communication	3	0	2	5	5	30	70	20	30	150
2.	PC	Data Communication & Networking	4	0	2	6	6	30	70	20	30	150
3.	PC	Optical Fiber Communication	3	0	2	5	5	30	70	20	30	150
4.	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5.	PE	**Programme Elective II**	3	0	2	5	5	30	70	20	30	150
		Microwave Engineering										
		Image Processing										
		Biomedical Instrumentation										
6.	OE	Open Elective -II	3	0	2	5	5	30	70	20	30	150
		Embedded Systems and applications										
		Total	**16**	**0**	**14**	**30**	**30**	**150**	**450**	**150**	**150**	**900**
		Semester - VIII										
1.	PC	Advance Communication system	3	0	2	5	5	30	70	20	30	150
2.	PC	Project – II	0	0	15	15	15	00	200	50	00	250
3.	PE	**Programme Elective – III**	3	0	2	5	5	30	70	20	30	150
		Radar & Navigational Aids										
		Device Driver writing										
		Machine learning										
4.	PE	**Programme Elective – IV**	3	0	2	5	5	30	70	20	30	150
		Virtual Instrumentation										
		Satellite Communication										
		Wireless Sensor Networks										
		Total	**9**	**0**	**21**	**30**	**30**	**90**	**410**	**110**	**90**	**700**

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Meeting of **BOS** of Electronics & Communication Engineering Branch, BVM (Autonomous), was held at **10:30 AM** on Date: 0**8-04-2017** for the following agenda items :

AGENDA ITEM 3 : EC1718.1.3

AGENDA	**DISCRIPTION**
EC1718.1.3	Equivalency of Third level autonomy subjects with equivalent GTU subjects as per Annexture-III

Annexture-III

Sr. No.	GTU		Autonomy		
	Semester	Code and Subject	Semester	Code and Subject	
1.	5	(2150001) Design Engineering - II A	5	(EC 306) Design Engineering	
2.	5	(2151002) Engineering Electromagnetics	5	(EC 301) Engineering Electromagnetics	
3.	6	(2161003) Antenna and Wave Propagation	6	(EC 308) Antenna and Wave Propagation	
4.	6	(2161001) Digital Communication	6	(EC 307) Digital Communication	

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5.	6	(2161006) Power Electronics Devices and Circuits	5	(EC 302) Power Electronics	
6.	6	(2161101) VLSI Technology and Design	5	(EC 304) VLSI Design	
7.	6	(2161103) Telecommunication Switching Systems and Networks	6	(EC 351) Telecom and Switching (PE – I)	
8.	6	(2161102) Advanced Microprocessor	6	(EC 309) Embedded Systems	

List of Subjects which are to be registered by the student in lieu of GTU subjects.

Sr. No.	GTU		Autonomy		
	Semester	Code and Subject	Semester	Code and Subject	
1.	5	(2151003) Disaster Management (Inst. Elec.)	5	(EC 305) Advance Microprocessors	
2.	5	(2151001) Microcontroller and Interfacing	5	(EC 303) Digital signal processing	

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3.	5	(2151004) Electronic and Communication	6	(EC 321) Open Elective – I Applied Electronics	
4.	5	(2151101) Audio Video Systems	6	(EC 310) Scripting Languages	
5.	5	(2151102) Mini Project	6	**(Program Elective –I)**	
6.	6	(2161005) Optical Communication		(EC 352) Industrial Automation	
7.	5	(2151002) Cyber Security (Inst. Elec.)		(EC 353) Digital Systems Design Using VHDL	
8.	6	(2160001) Design Engineering -II B			

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Engg. College
Vallabh Vidyanagar-388120.

Dr. B. C. Goradiya
Chairman, BOS, EC, BVM

HOD

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Meeting of **BOS** of Electronics & Communication Engineering Branch, BVM (Autonomous), was held at **11:30 AM** on **Date: 24 - 02-2018** for the following agenda items :

Agenda of the Meeting

EC1718.2.1 To discuss, suggest and approve detail syllabus of Final Level of UG Programme. (Annexure – I)

EC1718.2.2 Various NPTEL Courses offered as alternate of Available programme electives or as additional Programme Electives. (Annexure – II)

EC1718.2.3 To Approve Quality Assurance of Second, Third and Final Level autonomy subjects of UG Programme. (Annexure – III)

EC1718.2.4 Amendment in Final Level Sturcture and Approval of additional Open (Institute) Elective – II Subject in semester VII (Annexure – IV)

EC1718.2.5 To Approve Industry Project Guideline for short listed Student of Final Level of UG Programme (Annexure – V)

EC1718.2.6 To review of 1st year autonomous teaching structure specially subjects like Engineering graphics reduce credits of Elements of mechanical Engineering Basic civil engineering, increasing credits of Fundamental of Electronics subject of first Level of UG Pragramme (Annexure -VI)

Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
1.1	Dr. B C Goradiya	EC BoS	Started discussion of final level compulsory subjects,programme electives and open elective as per the structure approved in the previous BoS held in April 2017.
1.2	Prof. D C Dalwadi	EC BoS	Started explaining syllabi of wireless communication.
1.3	Mrs. Ekata Mehul	EC BoS	Add receiver concepts in wireless comm syllabi.
1.4	Dr. D C Dalwadi	EC BoS	Receiver concepts are already covered in Antenna and wave Propogation subject.
1.5	Dr. R A Thakkar	EC BoS	Include only measurement parameters ,remove CRO,DSO from lab delivery methods.

1.6	Prof. A A vahora	EC BoS	Started discussing Syllabi of DCN
1.7	Mrs. Ekata Mehul	EC BoS	We can cover network programming and protocols in lab sessions.
1.8	Dr. R A Thakkar	EC BoS	We can include network troubleshooting in Lab .
1.9	Dr. N J Kothari	EC BoS	I recommend appropriation of hours ,transport layer needs more hour ,others module also need to be adjusted in hours ,network layer should contain firewall.
2.0	Prof. P S Bhakher	EC BoS	stated explain syllabi of microwave engineering ,discussed contents of all modules and ask to add content of metamaterial.
2.1	Dr. N J Kothari and Dr. R A Thakkar	EC BoS	We should keep total 45 hours in microwave engineering syllabi
2.2	Dr. N J Kothari and Dr. R A Thakkar	EC BoS	We can add metamaterial introduction, include recent trends as active learning assignment.
2.3	Prof. G B Rathore	EC BoS	Started discussing syllabi of Biomedical instrumentation (BMI)
2.4	Dr. R A Thakkar	EC BoS	Appropriate contents is covered in BMI syllabi ,additionally we can add plasma base topic here .
2.5	Mrs. Ekata Mehul	EC BoS	You can ask hospitals to donate old medical equipment.
2.6	Prof. Anish vahora	EC BoS	Started discussing syllabi of device driver development.
2.7	Mrs. Ekata Mehul	EC BoS	We can add module six in lab sessions,start with I/O in beginning ,cover topics for synchronous communication like blocks and characters in lab .
2.8	Dr. R A Thakkar	EC BoS	Syllabi of Image processing is appropriate,try to explain small C programs in lab sessions.
2.9	Prof. H J Patel	EC BoS	Started discussing syllabi of embedded systems and applications.

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3.0	Dr. N J Kothari	EC BoS	Avoid core programing and RISC Architecture,add branch specific case studies .
3.1	Mrs Ekata mehul and others	EC BoS	Try to make syllabi comfortable for other branches
3.2	Prof. D C Dalwadi	EC BoS	Started discussing Syllabi of mobile comm (additional open elective)
3.3	Prof. R A Thakkar	EC BoS	We can find more appropriate contents or title ,we can also replace this subject with organic electronics subject OE – II.
3.4	Prof. K R Patel	EC BoS	Stated discussing syllabi of radar and navigational aids
3.5	Prof. R A Thakkar	EC BoS	Add NAVIC (IRNSS) receiver contents here.
3.6	Dr. R A Thakkar and Dr. N J Kothari	EC BoS	We can swept advance communication systems and wireless communication subject.
3.7	Prof . R M Patel	EC BoS	Stated discussing syllabi of machine learning subject
3.8	Er. Krunal Patel	EC BoS	We can cover simple algorithms like KNN
3.9	Prof . Mayur Sevak	EC BoS	Stated discussing syllabi of satellite Communication subject.
4.0	Dr. R A Thakkar	EC BoS	Suggested to put ISRO case studies .
4.1	Prof. D C Dalwadi	EC BoS	Stated discussing syllabi of wireless sensor networks subject.
4.2	All external experts	EC BoS	Include quantiki (free tool) based simulation in lab sessions
4.3	Dr. B C Goradiya	EC BoS	Stated discussing industry project guideline
4.4	Dr. R A Thakkar	EC BoS	Keep all IITs and NITs open for industry project include government research organization like PRL ,IPR for industry projects
4.5	All BoS experts	EC BoS	Recommends stipend to be paid to students for industry projects .
4.6	Dr. B C Goradiya	EC BoS	Started discussing Agenda 6 ,he proposed to reduce credits of Elements of mechanical Engineering , Engineering Graphics and Basic civil engineering & increase credits of Fundamental of Electronics

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			subject of first Level of UG Pragramme
4.7	All External Experts	EC BoS	All the external BoS members were agree to proposed amendment in credit structure of few first level subjects (as per agenda 6) to CDB OF BVM.

AGENDA ITEM 1: EC1718.2.1

AGENDA	DISCRIPTION
EC1718.2.1	To discuss, suggest and approve detail syllabus of Final Level of UG Programme. (Annexure – I)

Annexure – I

Programme Structure (Proposed and Approved) for **Final Level** of UG Electronics and Communication programme under BVM Autonomous w.e.f Academic Year: 2018-19

Sr. No	Course Type	Course	Teaching Scheme					Evaluation Scheme				
			L	T	P	H	C	M	E	I	V	TOTAL
		Semester - VII										
1.	PC	Wireless Communication	3	0	2	5	5	30	70	20	30	150
2.	PC	Data Communication & Networking	4	0	2	6	6	30	70	20	30	150
3.	PC	Microwave Engineering	3	0	2	5	5	30	70	20	30	150
4.	PC	Project – I	0	0	4	4	4	00	100	50	00	150
5.	PE	**Programme Elective II**	3	0	2	5	5	30	70	20	30	150
		Device Driver Development										
		Image Processing										
		Biomedical Instrumentation										

		Open Elective -II	3	0	2	5	5	30	70	20	30	150
6.	OE	Embedded Systems and applications Organic Electronics										
		Total	16	0	14	30	30	150	450	150	150	900
		Semester - VIII										
1.	PC	Optical Fiber Communication	3	0	2	5	5	30	70	20	30	150
2.	PC	Project – II	0	0	15	15	15	00	200	50	00	250
3.	PE	**Programme Elective – III** Radar & Navigational Aids Advanced Communication Systems Machine learning	3	0	2	5	5	30	70	20	30	150
4.	PE	**Programme Elective- IV** Virtual Instrumentation Satellite Communication Wireless Sensor Networks	3	0	2	5	5	30	70	20	30	150
		Total	9	0	21	30	30	90	410	110	90	700

Wireless Communication

CREDITS - 5 (L=L_3, T=T_0,P=P_2)

4th Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To understand concept of wireless communication systems and networks, cellular fundamentals, mobile radio propagation models, multiple access techniques and recent emerging trends.

Teaching and Assessment Scheme:

Teaching Scheme	Credits	Assessment Scheme

L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Wireless Communication Systems and Networks :** Evolution of mobile communications, Mobile Radio System around the world, Examples of Wireless communication Systems, 2G Cellular Networks, 3G Wireless Networks, 4G Wireless Networks, Wireless local loop (WLL), Wireless local area network (WLAN), Bluetooth and Personal Area Networks.	07	14
2	**Cellular Concept and its fundamentals :** Cellular system, Concept of frequency reuse, Channel Assignment Strategies, Handoff Strategies, Soft Handoff, Hard Handoff, Umbrella Cell Concept, Co-channel interference and system capacity, Adjacent channel interference, Trunking and GOS, Improving Coverage & Capacity in Cellular System- Cell splitting, Cell sectoring, Repeaters, Micro cell zone concept.	10	18

Unit No.	Topics	Teaching Hours	Weightage (%)
3	**Mobile Radio Propagation Model: Large-Scale Path and Small-Scale Fading :** Introduction to Radio wave propagation, Free Space Propagation model, three basic propagation mechanisms, Reflection, Two ray ground reflection model,Diffraction, Fresnel zone geometry, Knife-edge diffraction model, Scattering, Outdoor propagation models, Indoor propagation models, Small scale multipath propagation, Impulse response model for multipath channel, Parameters of mobile multipath channels, Types of small scale Fading, Rayleigh and Ricean distributions.	10	18
4	**Diversity and Multiple Access Techniques:** Introduction to diversity and its types, Selection diversity, Feedback diversity, Maximal ratio combining technique, Equal gain combining technique, Types of Multiple Access techniques - FDMA, TDMA and CDMA, OFDM transmitter and receiver.	06	16
5	**Wireless Systems – GSM and CDMA:** Basics of GSM system, GSM system architecture, GSM radio subsystem, GSM channel types, GSM speech processing, Concept of spread spectrum system, CDMA system Architecture, CDMA air interface, CDMA forward channels, CDMA reverse channels, CDMA call processing, RAKE Receiver concept, performance comparison of GSM and CDMA system.	08	18
6	**Recent emerging trends of wireless communication:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	04	16
	Total Hours	45	100

List of References:

1. T. S. Rappaport, *"Wireless Communications – Principles and Practice"*,Pearson Education, 2nd Edition, 2012.
2. T. L. Singal, *"Wireless Communications"*, McGraw Hill Education Private Limited, 2nd Edition, 2011.

3. A. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
4. W.C.Y.Lee, *"Mobile Communications Engineering"*,McGraw Hill Telecomm., 2nd Edition, 1998.

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the wireless communication systems and its standards.
2. Design the base station with respect to co-channel cells &adjacent channel cells concept.
3. Analyze and design the various indoor and outdoor mobile radio propagation model.
4. Understand and Compare the multiple access technologies in wireless communication.
5. Evaluate and design the GSM and CDMA wireless networks.
6. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	2	3	2	2	2	3	3	2	1	1	2	3	3	3	2
CO.2	3	3	3	2	2	2	2	2	3	2	2	3	2	2	2
CO.3	3	3	2	2	2	2	3	2	2	2	2	3	1	2	1
CO.4	3	3	2	2	2	3	1	2	2	2	2	3	2	2	2
CO.5	3	3	2	2	2	3	2	2	3	3	2	3	2	2	2
CO.6	2	3	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	2.67	3	2.17	2	2	2.67	2	2	2.33	2.17	2	3	2.17	2.17	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Part I: Using MATLAB Software various simulations are performed like probability of blocking and delaying with respect to Erlang B and Erlang C formula, parallel and perpendicular reflection coefficient, Rayleigh and Ricean distribution function, various mobile radio propagation model etc.
3. Laboratory: Part II: Performance of experiments using GSM and CDMA Trainer kits etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam,Assignments, Presentation,Experiments**
2.	CO.2	**Exam,Assignments, Presentation,Experiments**
3.	CO.3	**Exam,Assignments, Presentation,Experiments**

4.	CO.4	**Exam,Assignments, Presentation,Experiments**
5.	CO.5	**Exam,Assignment,Presentation,Experiments**
6.	CO.6	**Exam,Assignments, Presentation,Experiments**

Data Communication and Networking

CREDITS - 6 ($L=L_4$, $T=T_0$,$P=P_2$)

4th Year, B. Tech. (*Electronics and communication*)

Course Objective:

To familiarize students with computer networks different type of computer networks, mainly in the state of the current Internet protocol.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_4	T_0	P_2	C_6	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

UNIT NO.	Contents	Teaching Hours.	Weightage (%)
1	**Introduction to computer networks :** Network – Component and Categories – Topologies – Transmission Media – Reference Models: ISO/OSI Model and TCP/IP Model.	04	10

2	**Physical Layer :** Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN, Bluetooth, Connecting devices:-Repeaters, Hub, Bridges, Switch, Router, Gateways, Virtual LAN	10	15
3	**Data Link Layer:** Error – Detection and Correction – Parity – LRC-CRC – Hamming Code – Flow Control and Error Control – Stop and wait – ARQ – Sliding window – HDLC –Multiple Access Protocols –IEEE 802.3 Ethernet.*	12	20
4	**Network Layer:** IPv4 Datagram approach – IP addressing methods – Subneting – Routing – Distance Vector Routing – Link State Routing – Broadcast and Multicast Routing, Firewalls	10	15
5	**Transport Layer:** Transport Services – UDP -TCP - Congestion Control – Quality of Services(QOS)	10	15
6	**Application Layer:** Domain Name Space (DNS) – Electronic Mail - WWW – File transfer (FTP), electronic mails (SMTP), accessing remote terminals (telnet), accessing the world wide web (HTTP)	10	15
7	**Cryptography :** Introduction, symmetric-key cryptography, asymmetric-key cryptography	04	10
	Total Hours	60	100

List of References :

1. Andrew S Tanenbaum, "*Computer Networks*", 5th Edition, Pearson Education, 2013.
2. Behrouz A Forouzan, "*Data Communication and Networking*", 5th Edition, McGraw Hill, 2013 (E-Book available on the BVM intranet)
3. William Stallings, "*Data and Computer Communication*", 10/E, Pearson Education, 2013
4. James Kurose and Keith Rose, "*Computer Networking: A Top Down Approach*", 5th Edition, Pearson Education, 2010
5. Larry L Peterson and Bruce S Davie, "*Computer Networks: A Systems Approach*", 5th Edition, Elsevier, 2011

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand functionality of layered network architecture.
2. Categorize services offered by all layers in TCP/IP protocol stack
3. Examine the protocols operating at various layers of TCP/IP model.
4. Describe the process of designing and building data communications networks
5. Apply the cryptographic techniques in network.
6. Design and maintenance of individual network like home, office.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-'; (i.e., a dash) as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) & '-';: Not correlated

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	2	1	1	-	-	1	1	-	3	2	1	2
CO.2	3	2	3	2	1	1	-	-	2	2	-	3	2	2	2
CO.3	3	3	2	2	1	1	-	-	1	2	1	3	2	1	2
CO.4	3	2	2	2	1	1	-	-	1	2	-	3	2	1	2
CO.5	3	3	3	3	2	2	-	-	2	2	2	3	3	2	2
CO.6	3	3	3	3	3	3	-	-	3	2	2	3	3	2	3

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments C programming and Cisco Packet Tracer Software.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

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Microwave engineering

CREDITS – 5 (L=L_3, T=T_0,P=P_2)

4th Year, B. Tech. (*Electronics and communication*)

Course Objective:

To learn fundamentals of Microwave transmission lines, waveguides, Active and passive Microwave Devices, Microwave Components & its applications.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Introduction to Microwaves :** Microwave Frequencies, requirement of Microwave Frequencies, Advantages of Microwaves	02	05

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Unit No.	Topics	Teaching Hours	% Weightage
2	**Microwave Transmission Lines :** Transmission line Voltage and Current Relationship, Propogation Constant, Characteristic Impedance, reflection coefficient, standing waves, SWR, Concept of TE, TM,TEM Mode, Losses associated with microwave Transmission. Rectangular waveguides-theory and analysis,Principle of circular waveguide, Rectangular Cavity Resonator.	12	15
3	**Microstrip Lines :** Introduction to strip lines, Micro strip lines, parallel strip lines, coplanar strip lines, effect of dielectric constant,introduction to metamaterial.	06	10
4	**Microwave Components :** S-Parameter basics, Waveguide Tees, Directional Couplers, Wave-guide Corners, Bends, Twists, Circulators, Isolator .	07	20
5	**Microwave Tubes :** Klystrons, Helix and High power gridded control traveling wave tube, Magnetron Oscillators.	06	20
6	**Semiconductor Microwave Devices** : Microwave bipolar and hetero junction Transistors, Varactor diode, PIN diode, Tunnel Diode, Gunn Diode , IMPATT and TRAPATT diode, Parametric Amplifiers.	07	15
7	**Microwave Systems & applications :** Microwave antennas,Basic radar principle, Radar range equation, Types of radar, Radiometer System,Microwave Remote sensing , general industrial,medical and civil applications of microwaves,Microwave data transmission Links.	05	15
	Total Hours	45	100

List of References:

1. M. Kulkarni, "*Microwave and Radar Engineering*",4th Edition,Umesh Publishers,2012
2. Samuel Y. Liao, "*Microwave Devices and Circuit*", 3rd Edition,PHI,2003
3. Edgar Hund , "*Microwave Communications: Components and Circuits* ", Mc Graw Hill, ISE Edition,1989
4. David M Pozar, "Microwave Engineering", Wiley, 3rd Edition,2010

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand basic concepts and applications of microwave systems.
2. Design, analyze and solve problems related to microwave transmission lines.
3. Design, analyze and solve problems related to microwave waveguide.
4. Analyze, test and use ,maintain various passive microwave components .
5. Design and implement simple microwave strip lines, couplers.
6. Design and implement microwave sources

Course Articulation Matrix :

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	2	2	2	2	2	2	2	1	3	2	1	1
CO.2	3	3	3	2	1	2	2	2	2	2	2	3	2	2	2
CO.3	3	2	2	2	2	2	2	2	2	2	2	3	2	2	2
CO.4	3	2	2	2	2	2	2	2	2	2	2	3	2	1	1
CO.5	3	2	3	1	2	2	2	2	2	2	2	3	2	2	2
CO.6	3	2	2	1	2	2	2	2	2	2	2	3	2	2	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures etc.
2. Laboratory: Performance of Experiments Using Microwave test bench, Microwave sources, SWR meter, HFSS software, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments,Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments,Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments,Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments,Presentation,Experiments etc**

PROJECT - I
CREDITS - 4 (L=L_0, T=T_0, P=P_4)
4th Year, B. Tech. (Electronics and Communication)

Course Objectives :

To select and understand the project in the field of embedded system design, signal processing, image processing, information and communication technology, digital VLSI desing and antenna and microwave link etc.

Teaching Scheme			Credits	Marks Distribution		
				Practical Marks		Total Marks
L	T	P	C	ESE	CE	
L_0	T_0	P_4	C_4	ESE_{100}	CE_{50}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [20]	Viva [30]
Attendance/Work Planning /Presentations/Project Poster	Project Performance/ Report/Prototype/Questions & Answers

Course Guidelines:

1. Every student individually or in a group (group size is of 2-3 students. However, if project complexity demands a maximum group size of 4 students, the departmental committee should be convinced about such complexity and scope of the work.) shall take a project in the

beginning of the eighth semester it may be IDP(Industry Defined Project) or UDP(User Defined Project).

2. The individual's or group's project should involve analysis, design, and implementation and testing of substantial hardware, software or any combination thereof in the field of study of electronics and communication engineering.
3. The topic should be related to any application in the field of Electronics and Communication. Investigation of the latest development in a specific field of Electronics and Communication, the investigation of practical problem in the manufacture and / or testing of electronics, communication equipments, the Microprocessor / Microcontroller based application projects, Software development/Simulation project related to VLSI, Communication, Instrumentation, Signal Processing, Image Processing, GIS, Remote sensing applications, etc.
4. Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.
5. Periodical monitoring and assessment will be done by the internal guides.
6. A project report will be prepared and submitted for a viva examination at the end of the term along with their project poster, work planning sheet etc.
7. A good quality research paper is desirable to publish based on their project.

Course Outcome:

1. Apply the knowledge of electronics and communication engineering to the solution of electronics and communication engineering problems/project.
2. Review the research literature of selected project, and analyze complex engineering problems reaching substantiated conclusions.
3. Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data to design electronics and communication project.
4. Apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to design electronics circuits using relevant software and hardware for embedded, IOT, signal processing and communication based application.
5. Understand the impact of the electronics communication engineering solutions to societal and environmental contexts, ethical principles and norms of the engineering practice.
6. Function effectively as an individual, and as a member or leader in diverse teams to manage projects, communicate effectively and effective presentations of projects.

Course Articulation Matrix:

COs	PO1	PO2	*PO3*	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	*2*	2	2	2	2	2	2	2	2	1	3	1	1
CO.2	2	3	*2*	2	2	2	2	2	1	1	2	1	2	1	1
CO.3	2	2	*3*	2	1	2	2	2	2	2	2	1	2	1	3
CO.4	2	2	*2*	2	3	1	2	2	1	1	1	1	1	1	2
CO.5	2	2	*2*	2	2	3	2	3	1	1	2	1	1	1	2
CO.6	1	1	*1*	2	2	2	2	2	3	3	3	1	1	1	1
Avg.	2	2	*2*	2	2	2	2	2.16	1.66	1.66	2	1	1.66	1	1.66

Delivery Methods:

1. Guided to the students for selection of the project through startup and various ministry website, upgradation of past projects and other application oriented projects.
2. Guided to the students regarding IDP/UDP projects, preparation of work planning of project, Poster presentation event, review of various patents, review of research paper and other activity.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	Exam, Presentation, Software/Hardware Model
2.	CO.2	Exam, Presentation, Software/Hardware Model
3.	CO.3	Exam, Presentation, Software/Hardware Model
4.	CO.4	Exam, Presentation, Software/Hardware Model
5.	CO.5	Exam, Presentation, Software/Hardware Model
6.	CO.6	Exam, Presentation, Software/Hardware Model

Device Driver Development
(Programme Elective - II)
CREDITS - 5 (L=L_3, T=T_0, P=P_2)
4rd Year, B. Tech. (*Electronics and communication*)

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Course Objective:

To provide substantial practice with the key steps in developing Linux device drivers and how device drivers work, compile and load with the Linux kernel.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Labwork [10]
File	Attendance/ lab work/viva

Course Content:

Unit. No.	Content	Teaching Hr.	Weightage
1	**Review of Operating System :** Process ,Threads, Task, Concept of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions	7	15%
2	**I/O and Memory management :** Linux: memory management - Physical and virtual (kernel and user) address spaces, Linux memory management implementation, I/O register and memory range registration, I/O register and memory access, Read / write memory barriers.	10	20%
3	**Configuring, compiling and booting the Linux kernel :** Kernel configuration, Native and cross compilation, Generated files, Booting the kernel, Kernel booting parameters, Mounting a root filesystem	08	15%
4	**Kernel Module Programming :**	10	20%

	Static linking ,dynamic linking of modules, User space ,kernel space concepts, System calls, Writing simple modules, Writing Makefiles for modules		
5	**Character Device driver Development :** Driver concepts, Block & character driver distinction, Low level drivers, OS drivers etc, Writing character drivers, Device major, minor number, Interfaces to driver read, write, ioctl etc	**10**	**20%**
	Total Hours	**45**	**100**

List of References :

1. Robert Love, "*Linux Kernel Development*", 3rd Edition, Addison-Wesley Professional, 2010
2. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman," *Linux Device Drivers*", 3rd Edition, O'Reilly, 2005
3. Daniel Bovet, Marco Cesati," *Understanding the Linux Kernel*", 3rd Edition, , O'Reilly, 2005
4. Christopher Hallinan, "*Embedded Linux Primer -A Practical, Real-World Approach*", 2nd edition, Prentice Hall, 2010 .
5. Sreekrishnan Venkateswaran,"*Essential Linux Device Drivers*",1st Edition, Prentice Hall, 2008

Course Outcomes (Cos):
At the end of this course students will be able to

1. To familiar with the functions of Linux operating system
2. To learn Compile, install, run, and remove a live Linux source module.
3. To Design write, build, install, and run a specified custom module.
4. To understand how to configure, build, install and boot from a kernel.
5. To examine and use correctly the Linux kernel internal services needed by devices drivers
6. To analyze kernel debugging techniques with JTAG probes.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	1	1	1	2	1	-	-	2	-	-	2	3	2	3
CO.2	3	1	1	1	2	2	-	-	1	-	-	2	2	1	2
CO.3	2	3	1	1	3	1	-	-	1	-	-	2	3	2	3
CO.4	3	1	2	1	2	2	-	-	2	-	-	-	2	1	2
CO.5	3	2	1	1	3	1	-	-	1	-	-	2	1	1	3
CO.6	2	1	2	1	2	1	-	-	1	-	-	2	1	1	3
AVG.	2.67	1.5	1.33	1	2.33	1.33			1.33			2	2	1.33	2.67

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Embedded system kits

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1	CO.1	Exam,Assignments,Presentation,Experiments
2	CO.2	Exam,Assignments,Presentation,Experiments
3	CO.3	Exam,Assignments,Presentation,Experiments
4	CO.4	Exam,Assignments,Presentation,Experiments
5	CO.5	Exam,Assignments,Presentation,Experiments
6	CO.6	Exam,Assignments,Presentation,Experiments

IMAGE PROCESSING

(Programme Elective - II)

CREDITS - 5 (L=L_3, T=T_0,P=P_2)

4th Year, B. Tech. (Electronics &Communication)

Course Objective:

Describe and explain basic principles of digital image processing; design and implement algorithms that perform basic image processing, design and implement algorithms for advanced image analysis.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Assignment [05]	Attendance [05]
Lab File/Viva	Assignments/ Presentations/ Quiz	Laboratory Attendance

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Course Contents:

Unit No.	Topics	Teaching Hours	Weighted %
1	**Digital Image Fundamentals :** Light, brightness adaption and discrimination, Human visual system, Image as a 2D data, Image representation Gray scale and Colour images, Image sampling and quantization	04	08
2	**Image enhancement and filtering in spatial domain :** Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power-low transformation, Intensity level slicing and Bit-plane slicing. Image histogram, Histogram equalization process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening).	09	20
3	**Image filtering in the frequency domain :** Introduction to Fourier Transform, Preliminary Concepts, Extension to functions of two variables, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphism filtering, 2D- DFT, 2D-FFT, 2D- DCT.	09	20
4	**Image Restoration And Segmentation :** Noise models, Mean Filters , Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters ,Optimum Notch Filtering, Inverse Filtering, Wiener filtering Segmentation: Detection of Discontinuities, Edge Linking and Boundary detection, Region based segmentation, Morphological processing, erosion and dilation	09	20
5	**Wavelets And Image Compression :** Wavelets, Sub band coding, Multi-resolution expansions - Compression: Fundamentals, Image Compression models, Error Free Compression, Variable Length Coding, Bit, Plane Coding, Lossless Predictive Coding, Lossy Compression, Lossy Predictive Coding, Compression Standards	07	16

Unit No.	Topics	Teaching Hours	Weighted %
6	**Image Representation and Colour Image Processing:** Boundary representation, Chain Code, Polygonal approximation, signature, boundary segments, Boundary description, Shape number, Fourier Descriptor, Colour Fundamentals, Colour Models, Pseudo-colour image processing.	07	16
	Total Hours	45	100

List of References:

1. Rafael C. Gonzalez, Richard E. Woods. "*Digital image processing.*" ,Third Edition, Pearson Education ,2007
2. Jayaraman, S.,S. Esakkirajan and T. Veerakumar, "*Digital Image Processing*", McGraw Hill Publication, 1st Edition, 2017.
3. S Sridhar," *Digital Image Processing*", Second Edition, Oxford University Press,2011

Course Outcomes (COs):

After learning the course the students should be able to:

1. Understand image representation
2. Enhance image quality using image enhancement techniques in spatial domain
3. Enhance image quality using image enhancement techniques in frequency domain
4. Select the right image restoration technique to remove degradation from given image
5. Represent image using minimum number of bits using image compression
6. Do morphological operations on given image

Course Articulation Matrix :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	3	3	2	2	1	1	1	1	1	1	3	3	3
CO.2	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.3	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.4	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.5	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.6	3	3	3	3	3	3	1	1	3	1	1	1	3	3	3
Average	3.0	3.0	3.0	2.3	2.2	2.2	1.0	1.0	1.3	1.0	1.0	1.0	3.0	3.0	3.0

Delivery Methods:

1. Lectures: Using Black Board/ Power-point slides,Videos.

2. Laboratory: Performance of experiments using MATLAB and OPENCV to demonstrate the

basic concept of image processing.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**
2.	CO.2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Exam, Assignments, Presentation, Experiments**
5.	CO.5	**Exam, Assignment, Presentation, Experiments**
6.	CO.6	**Exam, Assignment, Presentation, Experiments**

Biomedical Instrumentation
(Programme Elective - II)
CREDITS - 5 (L=L_3, T=T_0,P=P_2)
4th Year, B. Tech. (*Electronics and communication*)

Course Objective :

The students will be familiar with the basics of Biomedical Instruments and Sensors in biomedical field.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

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Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Review of Biomedical Instrumentation:** The age of Biomedical Engineering, Development of Biomedical Instrumentation, Biometrics, Introduction to the Man- instrument System, Components of the Man- Instrument System, Physiological Systems of the Body	05	10
2	**Sources of Bioelectric Potentials:** Action and Resting Potential, Propagation of Action Potential, The Bioelectric Potential.	05	10
3	**Basic Transducers principles and Electrodes:** The Transducer and Transduction Principles, Active Transducer, Passive Transducers, Transducers for Biomedical Application. Electrode Theory, Bio-potential Electrode, Biochemical Transducer.	05	10
4	**The Cardiovascular System:** The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristic of Blood Flow, Heart Sounds.	05	10
5	**Cardiovascular Measurement:** Electrocardiography, Blood Pressure, Blood Flow and Cardiac Output, Plethysmography, Heart Sounds, Echocardiography, Color Doppler Instrument.	06	15
6	**Bio Medical Equipment :** ECG, EMG, EEG, Pace Maker, Defibrillator, LASER in Surgery, Equipment in Intensive Care Unit, Robotic Surgical Equipment, Invasive Medical Procedures, Biotelemetry systems. Plasma in Biomedical Applications.	07	15
7	**Medical Imaging :** Principle Of Radiation, Components Of X-Ray System, Principle Of CT Scan, MRI, PET Scan.	04	10

Unit No.	Topics	Teaching Hours	% Weightage
8	**Electrical Hazards & Patient safety in Bio-medical equipment:** Significance of Electrical Danger, Physiological Effect of Electrical Current, Ground Shock, Hazards and Methods of Accident Prevention.	04	10
9	**Patient Monitoring system:** Heart Rate Measurement, Pulse Rate Measurement, Respiration Rate Measurement, Blood Pressure Measurement, Microprocessor Applications in Patient Monitoring.	04	10
	Total Hours	45	100

List of References:

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "*Biomedical Instrumentation and Measurements*",PHI Private Limited, 2nd Edition, 2012.
2. John G. Webster, "*Medical Instrumentation Application and Design*", WSE Wiley India Private Limited, 3rd Edition, 2012
3. Joseph J. Carr, John M. Brown, "*Introduction to Biomedical Equipment Technology*", Pearson Education, 4th Edition, 2012.
4. R S. Khandpur, "*Handbook of Biomedical Instrumentation*", Tata McGraw Hill, 2nd Edition, 2002.

Course Outcomes (COs):

By learning this course students will be able to …

1. Recollect the basic knowledge of anatomy and physiology of human body.
2. Understand & Analyze important vital sign parameters to evaluate certain disease.
3. Categorize the differences of bio-potentials and its characteristics
4. To Design medical equipment fundamental circuits and to implement it for demonstration.
5. Study and measure various medical bio potentials.
6. Test safety related to electrical hazards and troubleshooting of biomedical instruments.

Course Articulation Matrix:

Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	1	1	2	1	2	1	1	1	3	2	1	1
CO.2	3	3	2	1	1	3	1	2	2	2	1	3	3	1	1
CO.3	3	2	1	1	1	2	2	2	2	2	2	3	3	1	1
CO.4	3	2	3	1	3	3	1	2	2	2	2	3	2	1	2
CO.5	3	2	2	1	1	2	1	2	2	2	2	3	2	2	1
CO.6	3	3	3	2	2	3	2	2	3	2	2	3	3	1	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Biomedical Trainer kits, Bread board, Active & Passive Components,ICs, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

Embedded Systems and Applications
(Open Elective II)
Credits - 5 ($L=L_3$, $T=T_0$,$P=P_2$)
4th Year, B. Tech. (Electronics and Communication)

Course Objective:

Design and Development of Hardware and Software design using Arduino for various application needs.

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Gujarat, India

Scope :

An Engineer not having basic knowledge on architecture of microcontrollers can kick-start making applications relevant to their branch or inter-branch using Arduino on completion of this course.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Projects/ Attendance/Lab File /Presentations	Experiment Performance/Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Introduction :** Numbering and coding systems, semiconductor memory, CPU architecture, Microcontrollers and Microprocessors, embedded system, Introduction to Arduino uno and Arduino IDE, creating sketch, uploading and running sketch. StructuringanArduino Program, Using data types and operations.	07	15
2	**Arithmetic and logical Operations:** Adding, Subtracting, Multiplying, and Dividing, Incrementing and Decrementing Values, Using Trigonometric Functions, Generating Random Numbers, Shifting Bits, Logical operations.	04	15
3	**Arduino and Peripherals:** Atmega328p pins and functions, IO port programming, Using a Switch, Reading a Keypad, Visual Output, Connecting and	04	15

Unit No.	Topics	Teaching Hours	% Weightage
	Using LEDs, Driving a 7-Segment LED Display		
4	**Serial Communication :** Introduction to serial communication, Sending Formatted Text and Numeric Data from Arduino, Receiving Serial Data in Arduino, Sending the Value of Multiple Arduino Pins, Data Logging.	08	15
5	**Getting Input from Sensors :** Reading Analog Values, Detecting Light, Detecting Motion (Integrating Passive Infrared Detectors), Measuring Distance, Detecting Vibration, Detecting Sound, Measuring Temperature, Reading RFID Tags, Tracking Rotary Movement, Getting Location from a GPS, Detecting Rotation Using a Gyroscope, Detecting Direction, Reading Acceleration.	11	20
6	**Physical Output :** Controlling Servo,Driving a Brushless Motor, Controlling Solenoids and Relays, Making an Object Vibrate, Controlling the Direction and Speed of a Motor with an H-Bridge, Driving a Stepper Motor. **Case studies:** 1. Motion Control with an Arduino 2. Ultrasonic Rangefinders 3. SCADA with Arduino 4. Requesting Data from a Web Server Serving Web Pages Using Forms 5. CNC Machine with Arduino 6. Smart Energy meter	11	20
	Total Hours	45	100

List of References:

1. Michael Margolis "*Arduino Cookbook*", First edition,O'Reilly Media, Inc., 2011
2. "Atmega328p Datasheet and user manual", Microchip online source

3. Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi,"*The AVR Microcontroller and Embedded Systems: Using Assembly and C*", third impression, Prentice Hall, 2011

4. Michael McRoberts,"*Beginning Arduino*", 2nd Edition ,Press, 2013

Course Outcomes (COs):

By learning this course students will be able to …

1. Recollect basic knowledge about microcontroller and its use
2. Understand & Analyze the functions of operation with data types and its use
3. Understand & Ability to use peripherals pins for application
4. Study and use serial communication
5. Design applications using sensor inputs
6. Ability to identify, formulate and solve engineering problems by using microcontroller.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:

1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	1	-	-	-	-	-	1	-	-	3	-	-	1
CO.2	3	2	1	-	-	-	-	-	1	-	-	3	2	1	1
CO.3	3	3	2	2	3	3	-	1	3	-	1	3	3	2	3
CO.4	3	3	3	1	2	3	-	1	2	-	-	3	3	3	3
CO.5	3	2	1	2	2	-	-	-	-	-	-	1	1	2	1
CO.6	3	3	3	3	3	2	-	-	3	2	1	2	2	3	3

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Arduino uno kits, Analog Trainer kits, Bread board, Active & Passive Components,ICs, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments,Presentation,Experiments etc**

3.	CO.3	**Exam,Assignments,Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments,Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments,Presentation,Experiments etc**

Organic Electronics
(Open elective II)
CREDITS - 5 (L=L_3, T=T_0,P=P_2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To understand the concept of RF systems, various wireless protocols and its applications related to electronics& communication.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	**Viva [10]**
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	**Topics**	**Teaching Hours**	**Weightage (%)**

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Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Introduction to RF & Wireless Technology:** Introduction, Complexity comparison, RF design – Multidisciplinary field, Applications, Analog and Digital Systems, Choice of technology.	04	12
2	**Evolution of Mobile Communication Systems:** Brief history of mobile communications, Advantages and disadvantages of mobile communications, wireless network generations, Comparison of wireless systems, applications of wireless communications.	06	16
3	**Mobile communication engineering:** Introduction, Radio paths, Propagation attenuation, Basic propagation CDMA 2000 technology. 4G-LTE.mechanisms, mobile radio channel, simulation of wireless fading channels, free space propagation model, indoor propagation model, outdoor propagation model.	08	18
4	**GSM & CDMA Systems:** GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, CDMA architecture.	12	20
5	**3G and 4G Digital Mobile Technology :** 2.5G TDMA evolution path, GPRS technology, EDGE technology, 2.5G CDMA technology, Need of 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, W-CDMA air interface, TD-SCDMA technology,	09	18
6.	**Emerging Wireless Network Technologies:** IEEE 802.11 WLAN technology, IEEE 802.15 WPAN technology, IEEE 802.16 WMAN technology, Mobile adhoc networks (MANETs), Wireless sensor networks, RFID technology, IEEE 802.21 standards overview.	06	16

Unit No.	Topics	Teaching Hours	Weightage (%)
	Total Hours	45	100

List of References:

5. T. L. Singal, *"Wireless Communications"*,2nd Edition ,McGraw Hill Education Private Limited, 2011
6. A.Goldsmith,"*WirelessCommunications*",1st Edition,Cambridge university press, 2005
7. B. Razavi, "*RF Microelectronics*", 1st Edition,PHI, 1998
8. W.C.Y.Lee, *"Mobile Communications Engineering"*,2nd Edition,McGraw Hill Telecomm, 1998

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the RF &wireless communication systems and its standards.
2. Analyze and design the various indoor and outdoor mobile propagation model.
3. Design the GSM wireless networks.
4. Evaluate and design the CDMA wireless networks.
5. Compare the 3G and 4G wireless technology.
6. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	2	3	2	2	2	3	3	2	1	1	2	3	3	3	2
CO.2	3	3	3	2	2	2	2	2	3	2	2	3	2	2	2
CO.3	3	3	2	2	2	2	3	2	2	2	2	3	1	2	1
CO.4	3	3	2	2	2	3	1	2	2	2	2	3	2	2	2
CO.5	3	3	2	2	2	3	2	2	3	3	2	3	2	2	2
CO.6	2	3	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	2.67	3	2.17	2	2	2.67	2	2	2.33	2.17	2	3	2.17	2.17	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Part I:Using MATLAB Software various simulations are performed like Rayleigh and Ricean distribution function, various mobile radio propagation model, BER of various modulation technology etc.
3. Laboratory: Part II:Performance of experiments using GSM and CDMA Trainer kits.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	Exam, Assignments, Presentation,Experiments
2.	CO.2	Exam, Assignments, Presentation,Experiments
3.	CO.3	Exam,Assignments, Presentation,Experiments
4.	CO.4	Exam, Assignments, Presentation,Experiments
5.	CO.5	Exam, Assignment, Presentation,Experiments
6.	CO.6	Exam, Assignments, Presentation,Experiments

OPTICAL FIBER COMMUNICATION

CREDITS - 5 ($L=L_3, T=T_0, P=P_2$)

4th Year, B. Tech. (*Electronics and communication*)

Course Objective:

To familiarize students with the propagation of light signal through optical fibers, the power penalty in a link, fiber amplifiers, coupling of power to optical fibers and losse setc.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

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Gujarat, India

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Basic principles of light propagation :** Electromagnetic spectrum,Optical Spectral bands,Evolution of fiber optic system, Elements of an optical fiber transmission link.	03	06
2	**Optical fibers - modal propagation :** Nature Of Light, Basic Optical Laws, Propagation Of Light In Fiber, Wavelengths, Frequencies, Channel Spacing, Optical Power, Types of Optical Fiber, Fiber Fabrication, Fiber Cables.	06	13
3.	**Signal distortion on optical fibers :** Attenuation, signal distortion in optical waveguide, pulse broadening in graded index fiber, mode coupling.	05	12
4.	**Optical sources :** Light emitting diode (LEDs)-structures, materials, Figure of merits, characteristics & Modulation,Laser Diodes -Modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, temperature effects.	06	12
5	**Power Launching & Coupling :** Source To Fiber Power Launching, Lensing Schemes, Fiber To Fiber Joints, Connectors, Splicing.	04	10
6	**Photo Detectors and Receiver System :** Principles of operation, types, characteristics, figure of merits of detectors photodiode materials, Receiver operation, Receiver Sensitivity, System Performance Evaluation Criteria, Eye Diagram, and BER.	04	09

Unit No.	Topics	Teaching Hours	% Weightage
7	**Transmission System :** Concept Of Digital Link, Point To Point Link, System Design Considerations, Link Power Budget, Rise Time Budget, Power Penalty.	03	10
8	**WDM Concepts and Components :** Principles of WDM, DWDM, Passive Optical Components, Tunable sources and Filters.	04	06
9	**Optical Amplifiers :** Principle Of Optical Amplification, Erbium—Doped Fiber Amplifiers, Raman Amplifiers, Semiconductor Optical Amplifiers.	03	06
10	**Advances in Optical Fiber Systems :** Telecommunications & broadband application, SONET/SDH, EDFA, Optical switching.	04	10
11	**Measurements :** Refractive Index Measurements, Attenuation Measurement, Dispersion Measurement, OTDR Field Applications.	03	06
	Total Hours	45	100

List of References:

1. Gerd Keiser,"*Optical Fiber Communications*", Mc Graw Hill, 5th Edition,2017.
2. G.Agrawal,"*Fiber optic Communication Systems*",John Wiley and sons,4th Edition,2010.
3. John M. Senior, "*Optical Fiber Communication*", PHI,3rd Edition,2010.

Course Outcomes (COs) :

By learning this course students will be able to ...

1. Understand the basic concept of optical fiber communication, fiber modes and structure configurations.

2. Evaluate the significance of the different kind of losses, signal distortion in optical system performance.
3. Clarify the various optical source materials, LED and Laser structures, quantum efficiency.
4. Analyze the fiber optical receiver operation and configuration.
5. Study and measure the system performance of optical transmitters, receivers and optical amplifiers.
6. Analyze and deign optical fiber link with encapsulation of different system components.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	1	1	1	1	1	2	2	1	3	1	3	1	3
CO.2	3	3	3	3	2	2	1	2	1	2	3	3	3	2	3
CO.3	3	1	2	2	1	2	1	1	2	2	3	3	3	2	3
CO.4	3	3	3	2	2	3	1	2	2	2	3	3	3	1	3
CO.5	3	2	2	3	3	3	1	1	2	2	3	3	3	1	3
CO.6	3	3	3	3	3	3	1	1	1	2	3	3	3	2	3

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Fiber optic Trainer kits, Bread board, Active & Passive Components, ICs, Function Generator, Oscilloscopes, Digital Multimeter, and Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Assignments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments etc**
3.	CO.3	**Assignments, Experiments etc**
4.	CO.4	**Exam, Assignments, Experiments etc**
5.	CO.5	**Exam, Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

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RADAR AND NAVIGATIONAL AIDS

(Programme elective – III)

CREDITS - 5 (L=L_3, T=T_0,P=P_2)

4th Year, B. Tech. (*Electronics and communication*)

Course Objective:

To provide knowledge of the basic concepts, operation and applications of various radar systems and navigational aids.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

UNIT No.	Topics	Teaching Hours	% Weightage
1	**Introduction :** Basic principle,Radar waveform ,powers and energy The s i m p l e f o r m o f R a d a r Range Equation, Block diagram and Operation,Radar displays,duplexers,Radar Frequencies,Applications of Radar.	03	07

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UNIT No.	Topics	Teaching Hours	% Weightage
2	**Radar Equation :** Prediction of Range , Minimum Detectable Signal ,Receiver Noise, Signal to Noise Ratio,Integration of radar Pulses,Radar Cross Section of Targets, Cross section Fluctuations and Models,surface clutter,sea clutter ,Weather clutter,Transmitter Power,Pulse Repetition Frequency and Range ambiguities, system losses,propagation effects, other overall considerations.	08	14
3	**CW and FM CW Radar:** Doppler effect,CW radar,FM CW radar,Airborne Doppler Navigation.	03	07
4	**MTI Radar:** Introduction, Delay line Cancellers, Staggered Pulse Repetition Frequencies, Range gated Doppler Filters,Block Diagram of Digital Signal Processor, Example of MTI radar Processor, Pulse Doppler Radar,Airborne radar.	05	14
5	**Tracking , Imaging and Electronic scanning Radar:** Tracking with Radar ,Monopulse tracking,Conical scan and Sequential lobing, Advantages, capabilities, phased array principle of electronic scanning, block diagram of an electronic scanning system and its operation	05	10
6	**Navigation:** Introduction, Four Methods of Navigation.	02	06
7	**Radio Direction Findings:** Loop Antenna, Loop input circuits, aural null direction finder,Adcock Direction Finder, Automatic Direction Finders.	04	10
8	**Radio Ranges:** LF/MF Four course Radio Range, VHF Omni Directional Range, VOR receiving & Ground Equipment.	03	07

UNIT No.	Topics	Teaching Hours	% Weightage
9	**Hyperbolic Systems of Navigation:** LORAN, DECCA navigation systems	**04**	**07**
10	**Aids to approach and Landing:** Instrument Landing System, Ground controlled Approach System, Microwave landing system	**04**	**08**
11	**Recent trends in Navigation :** GPS principle of operation, Track stabilization,Position location determination, GPS receiver and applications, GLONASS and Compass, GAGAN,Galileo,NAVIC Receiver and applications	**04**	**10**
	Total Hours	45	100

List of References :

1. Merril .I. Skolnik, "*Introduction to Radar System*",3rd Edition, McGraw Hill,2001
2. N S Nagraja,"*Elements of Electronic Navigation Systems*", 2nd Ed., McGraw-Hill, 2001
3. A.K Sen & A.B Bhattacharya,"*Radar Systems and Radio Aids to Navigation*",6/E,Khanna Publishers,2009
4. Peyton Z. Peebles, "Radar Principles ",2nd Edition,John Wiley and sons,2007
5. Mohinder S. Grewal, Lawrence R. Weill, Angus P. Andrews, "Global Positioning Systems, Inertial Navigation, and Integration," 2nd Edition, John Wiley & Sons,2007

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand basic concepts and applications of radar systems and navigational aids.
2. Identify the elements of radar transmitter and of radar receiver.
3. Analyze, test and use various radar & navigational aids for different applications.
4. Solve simple problems related to Radar systems.
5. Design, simulate and implement simple radar system,Component or process.
6. Design and implement simple Navigation aid ,Component or process.

Course Articulation Matrix:

***Note:** Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)'-':Not correlated

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	1	2	1	1	2	3	2	-	3	3	1	1
CO.2	3	2	2	1	2	2	1	2	3	2	-	3	2	1	1
CO.3	3	2	1	1	2	2	1	2	3	2	2	3	2	1	2
CO.4	3	3	2	1	2	3	1	2	2	2	2	3	2	2	2
CO.5	3	2	2	1	2	3	1	2	2	2	2	3	2	2	2
CO.6	3	2	2	1	2	3	1	2	3	2	2	3	2	2	2

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, animations.
2. Laboratory : Performance of Experiments Using RADAR Trainer kits, MATLAB, Oscilloscopes, and Digital Multimeter etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

Advanced Communication Systems
(Programme elective – III)
CREDITS - 5 (L=L_3, T=T_0, P=P_2)

4^{th} Year, B. Tech. (*Electronics and Communication*)

Course Objective :

This course provides comprehensive and advanced knowledge of broadband wireless communication systems. It includes the areas of Time diversity, Space diversity, Frequency diversity, Coding and decoding, Equalization, Smart antennas techniques, Multiuser detection and receiver.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Wireless Communications and Diversity :** Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space.	08	16
2	**Broadband Wireless Channel Modeling :** WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Autocorrelation, Jakes Spectrum, Impact of Doppler Fading.	07	16
3	**CDMA :** Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.	07	18

Unit No.	Topics	Teaching Hours	Weightage (%)
4	**OFDM :** Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.	07	16
5	**MIMO :** Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM,LTE.	08	18
6	**UWB (Ultrawide Band) :** UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB.	08	16
	Total Hours	45	100

List of References:

1. David Tse and Pramod Viswanath, *"Fundamentals of Wireless Communications"*, Cambridge University Press, 1st Edition, 2006.
2. A. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
3. T. S. Rappaport, *"Wireless Communications – Principles and Practice"*, Pearson Education, 2nd Edition, 2012.
4. W. C. Y. Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecommunications, 2nd Edition, 1998.
5. Ezio Biglieri, *"MIMO Wireless Communications"*, Cambridge University Press, 1st Edition, 2007.

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the basic concepts of wireless communications.
2. Describe and differentiate four generations of wireless standard for wireless networks.
3. Design wireless communication systems with key 3G and 4G technologies

4. Analyze the Error performance of Ultra Wide Band systems and applications to 4G Wireless standards.
5. Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.
6. Aware about the recent trends of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	2	3	2	1	1	3	1	-	1	1	1	3	3	3	2
CO.2	3	3	3	2	2	2	1	1	3	2	2	3	1	2	2
CO.3	3	3	2	2	2	2	1	-	2	2	1	3	1	2	1
CO.4	3	3	2	2	2	3	1	1	2	2	2	3	2	2	1
CO.5	3	3	2	2	2	3	-	2	3	3	2	3	1	2	2
CO.6	2	3	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	2.67	3	2.17	1.83	1.83	2.67	0.83	1.0	2.33	2.17	1.67	3	1.83	2.17	1.83

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Using MATLAB Software, various simulations are performed
3. Using available GSM and CDMA Trainer kits, various experiments are performed.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**
2.	CO.2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Exam, Assignments, Presentation, Experiments**
5.	CO.5	**Exam, Assignment, Presentation, Experiments**
6.	CO.6	**Exam, Assignments, Presentation, Experiments**

Machine Learning
(Programme elective – III)
CREDITS - 5 (L=L_3, T=T_0, P=P_2)

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

4^{th} Year, B. Tech. (Electronics & Communication)

Course Objective :

- Basic concepts of various learning methods
- To learn mathematical concepts and algorithms used in machine learning

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Assignment [05]	Attendance [05]
Lab File/Viva	Assignments/ Presentations/ Quiz	Laboratory Attendance

Course Contents:

Unit No.	Topics	Teaching Hours	Weighted %
1	**Introduction, Regression Analysis and Gradient Descent :** Introduction ,What is machine learning?, Supervised learning – introduction, Unsupervised learning - introduction Linear Regression, Linear regression - implementation (cost function), A deeper insight into the cost function - simplified cost function, Gradient descent algorithm, Linear regression with gradient descent	09	20
2	**Linear Algebra – review :** Matrices – overview, Vectors – overview, Matrix manipulation, Implementation/use, Matrix multiplication properties, Inverse and transpose operations	02	04

Unit No.	Topics	Teaching Hours	Weighted %
3	**Linear Regression with Multiple Variables :** Linear regression with multiple features, Gradient descent for multiple variables, Gradient Decent in practice: 1 Feature Scaling, Learning Rate α , Features and polynomial regression, Normal equation, Normal equation and non-invertibility	09	20
4	**Logistic Regression :** Classification, Hypothesis representation, Decision boundary Non-linear decision boundaries, Cost function for logistic regression, Simplified cost function and gradient descent, Advanced optimization, Multiclass classification problems	09	20
5	**Neural Networks – Representation :** Neural networks - Overview and summary, Model representation 1 (with brain stuff), Model representation 2 (without brain stuff), Neural network example - computing a complex, nonlinear function of the input, Multiclass classification	07	16
6	**Neural Networks – Learning :** Neural network cost function, Summary of what's about to go down, Back propagation algorithm, Back propagation intuition, Implementation notes - unrolling parameters (matrices), Gradient checking, Random initialization, Putting it all together	09	20
	Total Hours	45	100

List of References:

1. Rajasekaran, Sanguthevar and GA Vijayalakshmi Pai, "*Neural networks, fuzzy logic and genetic algorithm: synthesis and applications*",*Paperback Edition* ,PHI , 2003.
2. Jang, Jyh-Shing Roger, Chuen-Tsai Sun, and Eiji Mizutani."*Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence*" ,*paper back Edition,2007*
3. Leave, Charles."*Neural Networks: Algorithms, Applications and Programming Techniques.*", *Journal of the Operational Research Society*,1992
4. Klir, George,Bo Yuan, "*Fuzzy sets and fuzzy logic*",1st edition, Prentice hall, 2011.
5. Konar, Amit, "*Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain*,1st edition, CRC press, 1999.

6. Friedman, Jerome,Trevor Hastie, and Robert Tibshirani,"*The elements of statistical learning*", Vol. 1, Springer series in statistics, 2001.
7. Alpaydin, Ethem, "*Introduction to machine learning*", MIT press, 2014.
8. Bishop, Christopher M," *Pattern recognition and machine learning* ",1st/E,springer, 2006.
9. Murphy, Kevin P," *Machine learning: a probabilistic perspective*",Hard cover Edi., MIT press, 2012.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Understand fundamental issues and challenges of machine learning.
2. Understand of the strengths and weaknesses of many popular machine learning approaches.
3. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
4. design and implement various machine learning algorithms in a range of real-world applications.
5. Design and implement unsupervised learning methods
6. Design and implement supervised learning methods

Course Articulation Matrix :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	3	3	2	2	1	1	1	1	1	1	3	3	3
CO.2	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.3	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.4	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.5	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
CO.6	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
Average	3.0	3.0	3.0	2.3	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	3.0	3.0	3.0

Delivery Methods:

1. **Lectures:** Using Black Board/ Power-point slides,Videos.
2. **Laboratory:** Performance of experiments using MATLAB and Python to demonstrate the basic concept of image processing.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**

2.	CO.2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**
4.	CO.4	**Exam, Assignments, Presentation, Experiments**
5.	CO.5	**Exam, Assignment, Presentation, Experiments**
6.	CO.6	**Exam, Assignment, Presentation, Experiments**

Virtual Instrumentation
(Programme elective -IV)
CREDITS - 5 ($L=L_3$, $T=T_0$,$P=P_2$)
4th Year, B. Tech. (Electronics and communication)

Course Objective :

Make use of software platform for analysis and application design for computer based systems.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	**Viva [10]**
Projects/ Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	**Topics**	**Teaching Hours**	**% Weightage**

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Gujarat, India

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Virtual Instrumentation:** Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems	09	10
2.	**VI programming techniques:** VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O. Use of spreadsheet for data logging.	09	20
3.	**Data acquisition basics:** Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. ADC, DAC, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.	07	15
4.	**Hardware Interfacing:** VI Chassis requirements Common Instrument Interfaces: Current loop, RS 232, GPIB, PCI card communication, NI DAQ MAX	04	15
5	**State Machines:** Enumerated Types and Type Definitions, Sequence-Style State Machine, Test Executive-Style State Machine, Classical-Style State Machine, Queued-Style State Machine, Drawbacks to Using State Machines.	05	20
5.	**Case Study:** Use of RS232 for Data Acquisition and logging system Use of Ethernet for Data Acquisition and logging system Use of Database for data logging and retrieval Use of report generation of logged data	03	20
	Total Hours	45	100

List of References:

1. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki *"LabView: Advanced Programming Techniques"*, Second Edition,CRC Press ,2006
2. Malan Shiralkar, *"LabVIEW Graphical Programming Course"*, National Instruments, 2007
3. Ronald W. Larsen, *"LabVIEW for Engineers", 1st Edition,* Prentice Hall, 2011
4. Lutz Bier, *"MSP430 Family Mixed-Signal Microcontroller Application Reports"*, Texas Instruments, 2000.

Course Outcomes (COs):

By learning this course students will be able to …

1. Recollect basic knowledge of programming languages.
2. Understand & Analyze the processing requirement for application.
3. Identify, formulate and solve engineering problems
4. Design small program for applications
5. Study and use third party devices to integrate with application.
6. Understand and design PC based applications.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	1	-	-	-	-	-	1	-	-	3	-	-	1
CO.2	3	2	1	-	-	-	-	-	1	-	-	3	2	1	1
CO.3	3	3	2	2	3	3	-	1	3	-	1	3	3	2	3
CO.4	3	3	3	1	2	3	-	1	2	-	-	3	3	3	3
CO.5	3	2	1	2	2	-	-	-	-	-	-	1	1	2	1
CO.6	3	3	3	3	3	2	-	-	3	2	1	2	2	3	3

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using NI ELVIS Kit, LabVIEW Software, NI Devices, Bread board, Active & Passive Components,ICs, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

Satellite Communication
(Programme Elective -IV)
CREDITS - 5 ($L=L_3$, $T=T_0$,$P=P_2$)
4th Year, B. Tech. (*Electronics and communication*)

Course Objective :

To understand basic aspects of Satellite Communication and role of satellite in various applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

ELECTRONICS & COMMUNICATION DEPARTMENT
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Vallabh Vidyanagar – 388120
Gujarat, India

Unit No.	Topics	Teaching Hours	% Weightage
1	**Introduction :** The origin of satellite communications, A brief history of satellite communications, The current state of satellite communications, An overview of satellite communications.	02	7%
2	**Orbits and Launching Methods :** Introduction, Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit perturbations, Effect of non spherical earth, Atmospheric drag. Introduction of GEO orbit, Antenna look angles, Polar mount antenna, Near Geo stationary orbits, Earth Eclipse of satellite, Sun transit outage, launching orbits	05	15%
3	**Space Segment:** Introduction, Spacecraft Subsystem, Attitude and orbit control system, Telemetry, tracing and command system, Power Systems, Communications subsystem, Spacecraft Antennas, Equipment reliability and space qualification.	06	14%
4	**Satellite Link Design:** Basic transmission theory, System noise temperature and G/T ratio, Design of downlink, Domestic satellite systems using small earth stations, Uplink design, Design of satellite links for specified C/N.	04	12%
5	**Multiple Access Techniques for Satellite Links:** Multiple Access Techniques, Frequency Division Multiple Access, Time Division Multiple Access, On Board Processing, Demand Access multiple Access, Random Access, Code Division Multiple Access.	04	12%

Unit No.	Topics	Teaching Hours	% Weightage
6	**Propagation Effects and their Impact on Satellite Earth – links:** Quantifying Attenuation and Depolarization, Propagation Effects that are not associated with hydrometers, Rain and Ice effects, Prediction of Rain attenuation, Prediction of XPD and Propagation impairment countermeasures.	04	7%
7	**Low Earth Orbit and Non-Geostationary Satellite Systems:** Orbit Considerations, Coverage and Frequency Considerations, Delay and throughput considerations, Operational NGSO Constellation Design.	03	7%
8	**Direct Broadcast Satellite TV and Radio :** C-Band and Ku Band Home Satellite TV, Digital DBS-TV,DBS-TV System Design, DBS-TV link Budget, Error Control in Digital DBS TV,DBS-TV Link Budget,Master Control Station and Uplink	02	8%
9	**Satellite Navigation and Global Positioning System :** Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Level, Timing Accuracy and GPS Receiver Operation	03	8%
10	**Satellite communication Case Studies :** Mars Orbiter Mission,LVM3-X (CARE),AstroSat, PSLV-C40/Cartosat-2 Series Satellite PSLV-C39/IRNSS-1H Mission,GSAT-17,PSLV-C38 / Cartosat-2 Series Satellite, Gslv-Mk Iii-D1 / Gsat-19, Niusat, Pisat,Pratham Sathyabamasat, Swayam	02	10%
	Total Hours	45	100

List of References :

1. Timothy Pratt, Charles Bostian, Jeremy Allnut, "*Satellite Communication*", 2nd Edition , Jhon Wiley & Sons,2012
2. Dennis Roddy, "*Satellite Communications*",4th Edition ,McGraw Hill,2012.
3. Anil K. Maini, Varsha Agarwal , "*Satellite Technology, Principles and Applications*",2nd Edition, Wiley,2014.

Course Outcomes (COs) :

By learning this course students will be able to ...

1. Recollect basic knowledge from principles of satellite communication.
2. Understand & Analyze various orbits, satellite segment and its opreations
3. Categorize various satellite applications according to usage .
4. Design Satellite Communication Link.
5. Study various methods for satellite access.
6. Learn Direct broadcasting of audio/video using satellites.

Course Articulation Matrix:

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	2	1	2	3	1	2	2	2	2	3	3	2	2
CO.2	3	2	3	2	2	3	2	2	2	2	2	1	2	3	2
CO.3	3	2	2	2	2	2	3	2	2	3	3	2	2	2	2
CO.4	3	2	3	3	2	2	3	3	2	2	1	3	2	2	2
CO.5	3	2	2	2	2	3	2	3	2	2	3	3	2	2	3
CO.6	3	2	2	3	3	3	3	2	3	2	3	3	2	3	2
AVG.	3	2	2.33	2.16	2.16	2.66	2.5	2.33	2.16	2.16	2.33	2.5	2.16	2.33	2.33

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos.
2. Laboratory: Performance of Experiments Using Satellite Trainer kits, Function Generator, Oscilloscopes, Digital Multimeter, Power Supply, Matlab Software etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments**
2.	CO.2	**Exam,Assignments, Presentation,Experiments**
3.	CO.3	**Exam,Assignments, Presentation,Experiments**
4.	CO.4	**Exam,Assignments, Presentation,Experiments**
5.	CO.5	**Exam,Assignment,Presentation,Experiments**
6.	CO.5	**Exam, Assignments, Presentation,Experiments**

Wireless Sensor Networks
(Programme elective -IV)
CREDITS - 5 (L=L_3, T=T_0, P=P_2)
4^{th} Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To design the wireless sensor network and its applications using MAC, routing and transport protocol with network management and different operating systems.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_2	P_0	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

Details of Assessment Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Tutorial/Presentations	Questions & Answers

Course Contents:

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Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Introduction and Overview of Wireless Sensor Networks:** Introduction, Background of Sensor Network Technology, Applications of Sensor Networks, Basic overview of the technology, Basic Sensor Network Architectural Elements, Brief Historical Survey of Sensor Networks, Challenges and Hurdles of sensor network.	05	14
2	**Applications of Wireless Sensor Networks:** Introduction, Range of Applications, Examples of WSN applications – Home Control, Building automation, Industrial automation, Medical applications, Sensor and robots, Reconfigurable sensor networks, Highway monitoring, Military applications, Wildfire instrumentation, Nanoscopic sensor applications.	08	16
3	**Wireless Sensor and Transmission Technology:** Introduction, Sensor node technology – overview, hardware and software, sensor taxonomy, WN operating environment, WN trends, available wireless technologies – campus applications, MAN/WAN applications.	05	14
4	**MAC Protocols for Wireless Sensor Networks:** Introduction, Fundamentals of MAC protocols – Performance requirements, Common protocols, MAC protocols for WSN – Schedule based protocols, Random access based protocols, Sensor-MAC case study, IEEE 802.15.4 LR-WPANs Standard Case Study.	05	15
5	**Routing Protocols for Wireless Sensor Networks :** Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks – Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks – WSN Routing Techniques, Flooding and its Variants, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed diffusion, Geographical routing.	11	17

Unit No.	Topics	Teaching Hours	Weightage (%)
6	**Transport Control Protocols for Wireless Sensor Networks :** Traditional Transport Control Protocols – TCP, UDP, Mobile IP, Feasibility of Using TCP or UDP for WSNs, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols – CODA, ESRT, RMST, PSFQ, GARUDA, ATP, Performance of Transport Control Protocols.	06	14
7	**Network Management and Operating Systems for WSN :** Network management requirements, Networks management design issues, Examples of management architecture – MANNA, Examples of operating systems – TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS, EMERALDS, PicOS.	05	10
	Total Hours	45	100

List of References:

1. K. Sohraby, D. Minoli, T. Znati, *"Wireless Sensor Networks – Technology, Protocols and Applications"*, Wiley Publications, 2nd Edition, 2007.
2. H. Karl, A. Willig, *"Protocols and Architectures for Wireless Sensor Networks"*, Wiley Publication, 2nd Edition, 2005.
3. E. H. Collaway, *"Wireless Sensor Networks – Architectures and Protocols"*, CRC press, 2nd Edition, 2004.

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the concept of wireless sensor network and its architecture.
2. Illustrate with architectures, functions and performance of wireless sensor networks and its applications.
3. Explain the various wireless sensor and transmission technology.
4. Analyse the specific requirements for applications in wireless sensor networks regarding energy supply, memory, processing and transmission capacity.
5. Design the WSN based on various protocols like MAC, routing, and transports layer.
6. Understand the concept of network management and operating systems for WSN.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	2	2	2	3	3	2	1	1	2	3	3	3	2
CO.2	3	3	3	2	2	2	2	2	3	2	2	3	2	2	2
CO.3	3	3	2	2	2	2	3	2	2	2	2	3	1	2	1
CO.4	3	3	2	2	2	3	1	2	2	2	2	3	2	2	2
CO.5	3	3	2	2	2	3	2	2	3	3	2	3	2	2	2
CO.6	3	3	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	3	3	2.17	2	2	2.67	2	2	2.33	2.17	2	3	2.17	2.17	2

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures etc.
2. Laboratory : MATLAB simulation program of various protocols, available wireless sensor networks simulation tools.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation,Tutorials**
2.	CO.2	**Exam, Assignments, Presentation, Tutorials**
3.	CO.3	**Exam, Assignments, Presentation, Tutorials**
4.	CO.4	**Exam, Assignments, Presentation, Tutorials**
5.	CO.5	**Exam, Assignments, Presentation, Tutorials**
6.	CO.6	**Exam, Assignments, Presentation, Tutorials**

AGENDA ITEM 2 : EC1718.2.1

AGENDA	DESCRIPTION
EC1718.2.2	Various NPTEL Courses offered as alternate of Available programme electives or as additional Electives for UG Programme under BVM Autonomous Scheme (Annexure - II)

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Annexure – II

Sr. no	Course id	Discipline	Course name	Instructor	Institute	Duration	Credits
1	noc17-cs22	Computer science and engineering	Introduction to internet of things	Prof. Sudip Misra	IITKGP	12 weeks	5
2	noc17-ee22	Electronics & Communications	Computational Electromagnetics & Applications	Prof. Dr. Krish Sankaran	IITM	12 weeks	5
3	noc17-ec06	Electronics & Communications	Design of photovoltaic systems	Prof. L Umanand	IISc	12 weeks	5
4	noc17-ec12	Electronics & Communications	Modern digital communication techniques	Prof. Suvra Sekhar Das	IITKGP	12 weeks	5
5	noc17-ec05	Electronics & Communications	Enclosure design of electronics equipment	Prof. N V Chalapathi Rao	IISc	12 weeks	5
6	noc17-ec15	Electronics & Communications	Analog Circuits and Systems through SPICE Simulation	Prof. Mrigank Sharad	IITKGP	12 weeks	5
7	noc17-ec13	Electronics & Communications	Digital speech processing	Prof. Shyamal Kumar Das Mandal	IITKGP	8 weeks	3
8		Electronics & Communications	Optimization Techniques for Digital VLSI Design	Prof. ChandanKarfa Prof. Santosh Biswas	IITG	8 Weeks	3

Note: (i) for 12 weeks NPTEL course total credits offered is 5.
(ii) Students has to take atleast two 8 weeks Courses in order to get total 5 course credits.

Draft Rules for offering NPTEL Courses as alternate Program Electives with transfer of Credit in BVM (Autonomous Structure) UG and PG to be implemented from AY: 2018-19 for existing students

1. This rules are prepared as the guideline of AICTE Notification No. 332 dated August 22, 2016 and Curriculum Development Board meeting point number CDB1718.3.4 convened on 6th October 2017.

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Gujarat, India

2. The NPTEL courses decided by respective BoS shall be on advanced or recent topics. They should not have similar or overlapping contents to the core subjects offered by respective branch.
3. Each branch BoS for UG and PG shall approve a list of around 5 to 15 (number as per their suitability) NPTEL subjects of 8 week and 12 week duration. These subjects shall be offered as alternate to departmental/program electives of the branch mentioned in their structure in any semester (5 to 8 semester).
4. The courses for 8 weeks in NPTEL will be considered equivalent to 3 or 4 credit elective
5. The courses for 12 weeks in NPTEL will be considered equivalent to 5 or 6 credit Electives
6. Respective BoS can decide eligibility criteria to restrict the students on meritorious grounds. For example, a criteria of CPI >= 7.5 may be kept as a criteria when student applies for exemption from departmental/program elective.
7. These courses are not valid as an alternative to Institute or Open Elective.
8. The 4 week courses offered by NPTEL are not valid for alternate program elective under this scheme.
9. Students can register and give exam for these NPTEL courses in any semester starting from their third year (5^{th} Sem. Onwards) to final year (8^{th} sem.). The justification for this provision is that the offering of NPTEL courses may not be consistent in every semester. Different set of course are offered in odd and even semester.
10. The validity of NPTEL course result will be considered up to two years for getting credit transfer against college program elective.
11. The students can inform faculty counsellor and Credit System registration office whether they want to do credit transfer of NPTEL course against Program Elective I/II/III/IV/V etc., depending upon credit equivalence as mentioned in point 4 and 5 above. They can do this immediately after getting the result from NPTEL. He will inform for getting credit transfer and exemption for one of his elective in next (upcoming) semester. A form shall be designed for this purpose which will be having signature of Faculty Counsellor, HOD and then submit to Credit System In-charge or Controller of Exam.
12. When the students register for the courses, they should inform the NPTEL Implementation committee member of each department and the HoD. If 10 or more students are registering for a NPTEL course then department shall assign a mentor. A faculty member will register in NPTEL interface as a mentor for that course and inform the NPTEL Coordinator /Single Point of Contact of the BVM NPTEL Local Chapter. The mentro will supervise and motivate students for regular video lecture viewing, study, assignment submission and registering for the exam of that NPTEL course. Mentor is issued certificate from NPTEL with grade based on student performance in that course.
13. The list of NPTEL courses will be updated every year as per offering and availability of more courses by NPTEL. Please mention your BVM ID No. (not GTU enrollment number) in your NPTEL profile to get benefit of reimbursement.NPTEL reimbursement of 50 % will be provided to SFI students for 1 course only (irrespective of the number of courses they have registered or passed)

    As before, candidates will have to pay the full fees while registering for exam.

    50% refund will be refunded to those candidates who

1) pass the exam with at least 40% marks and
2) they are approved by NPTEL for fee waiver

IMPORTANT
Even though a candidate has been recommended by the SPOC, he/she still has to be approved by NPTEL for fee waiver.
NPTEL reserves all rights to approve/reject candidates.
NPTEL reserves all rights to amend the afore-mentioned conditions.

How to apply for fee waiver (scholarship)

STEP 1: Login to the online courses portal [https://onlinecourses.nptel.ac.in/] using your SPOC email-id shared with us [Google enabled].
STEP 2 : After logging in, on the right hand top corner - click on your email id You will be able to find the LOCAL CHAPTER SPOC option. Click on this.
STEP 3: TOTAL ENROLLMENTS/ ENABLING SCHOLARSHIP
Please click on Manage > All Local Chapter Students
Here, you can get the list of all candidates from your college, with their basic details and list of courses to which each person has enrolled
(available as csv download too). The option to enable scholarships is also available .
STEP 4: Please scroll to the right side of the screen and mark in the check box against each candidate's name whom you want to recommend for scholarship.
STEP 5: Save the data.
More details can be found
at: http://nptel.ac.in/LocalChapter/reference_document.php > Topic:
SPOC Login features via Course Portal.
In the onlinecourses portal, the data is updated dynamically. Hence, please visit this portal Regularly and enable your candidates' scholarship.
In the online courses portal, the data is updated dynamically. Hence, please visit this Portal Regularly and enable your candidates' scholarship.
RECOMMENDATION TO SPOCs
Since we have limited funds, we have the following recommendations:

1. Colleges where you felicitate students with monetary incentives after the exam – request you to utilize these funds to support exam fees for your students now.
2. Colleges where management is contributing to fee waivers - please do not apply for Fee Waiver.

Please recommend only the most deserving candidates.

14. The methodology of evaluation by NPTEL is as follows:

- Calculation of final score:
  Consolidated score = 25% assignment score + 75% certification exam score
  Assignment = 25% of average of:

Best 6 out of 8 assignments in an 8 week course
Best 8 out of 12 assignments in a 12 week course

- Certificates are provided for students who have a consolidated score of 40% and above.
  Final score between 40 % 59 % : Certificate type -"Successfully completing the course"
  Final score between 60% -89%: Certificate with tag "Elite" printed at the top
  Final score of 90% and above: Certificate with "Elite" tag and the gold medal printed on it.
- For the course toppers will have a "Topper" seal on the certificate as per the criteria given below. This will also be published on the website under each course as Toppers.
  Toppers in courses:
  The following has been the logic used to determine the course toppers:
  If in a course, X = Number certified , then the number of toppers will be:
  X <= 10 : 1 person is the course topper
  10 < X <= 50: Top 2 of the course
  50 < X <= 100: Top 5 of the course
  X > 100 : Top 1%, 2%, 5% will be mentioned on the portal and on the certificates
  Total number certified will also be displayed on the certificate
- Categories of certificates based on Final Consolidated score:
  40 – 59 : Successfully completed;
  60 – 89: Elite ;
  >=90: Elite + gold

15. The conversion from percentage marks given by NPTEL to grades of BVM Autonomous will be as follows:

Sr. No.	Range of Percentage Marks obtained in NPTEL Exam	Equivalent Grade in BVM Autonomous
1	85-100	AA
2	70-84	AB
3	60-69	BB
4	55-59	BC
5	50-54	CC
6	45-49	CD
7	40-44	DD
8	0-39	FF

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AGENDA ITEM 3 : EC1718.2.3

AGENDA	DESCRIPTION
EC1718.2.3	To approve Quality Assurance of Second, Third and Final Level subjects of UG Programme under BVM Autonomous Scheme as per Annexure-III

General Quality Assurance Guidelines

SR. No.	Level	Bloom's Taxonomy Level with % Distribution
1	IInd	R + U + A level → 70% - 75% N + E + C level → 25% - 30%
2	IIIrd	R + U + A level → 60% - 65% N + E + C level → 35% - 40%
3	IVth	R + U + A level → 55% - 60% N + E + C level → 40% - 45%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Annexure-III

Quality Assurance
2nd Level

EC 201: Electronic Devices and Circuits

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)

R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 202 : Network Analysis and Synthesis

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**20**	**25**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 203: Digital Circuit Design

Suggested specification table with marks (Theory) :

Distribution of Theory Marks %					
R Level	U Level	A Level	N Level	E Level	C Level
25	**20**	**25**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 204 : Object Oriented Programming

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level

25	**25**	**20**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 206 : Control System Engineering

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**15**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 207: Electronic Measurements and Instrumentation

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**15**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 208: Electronics and Communication

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**15**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 209: Microcontroller and Interfacing

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Quality Assurance
3rd Level

EC 301: Engineering Electromagnetics

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**20**	**20**	**15**	**15**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 302 : Power Electronics

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**20**	**26**	**7**	**7**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 303 : Digital Signal Processing

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	**25**	**15**	**15**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 304 : VLSI Design

Suggested specification table with marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**15**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 305 : Advance Microprocessors

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	20	10	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 307 : Digital Communication

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**15**	**15**	**15**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 308 : Antennas and Wave Propagation

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**15**	**20**	**20**	**15**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

EC 309 : Embedded Systems

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**15**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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EC 310 : Telecom and Switching

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**15**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

EC 352 : Industrial Automation

Suggested specification table with marks (Theory) :

Distribution of Theory Marks %					
R Level	U Level	A Level	N Level	E Level	C Level
20	**25**	**20**	**15**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

EC 353: Digital Systems design Using VHDL

Suggested specification table with marks (Theory) :

Distribution of Theory Marks %					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**15**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

EC 371 : Applied Electronics

Suggested specification table with marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**25**	**20**	**15**	**15**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Quality Assurance
4th Level

Wireless communication

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	**25**	**15**	**20**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Data Communication & Networking

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	15	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Microwave Engineering

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Device Driver Development

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	20	15	15	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Image Processing

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Biomedical Instrumentation

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	25	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Embedded Systems and applications (OE - II)

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	20	10	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Organic Electronics (OE –II)

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	15	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Optical Fiber Communication

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	20	15	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Radar and Navigational Aids

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Advanced Communication systems

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Machine learning

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	15	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Virtual Instrumentation

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	15	10	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Satellite Communication

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**20**	**20**	**15**	**15**	**05**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

Wireless Sensor Networks

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Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**15**	**15**	**15**	**05**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks may vary slightly from above table.

AGENDA ITEM 4: EC1718.2.4

AGENDA	DESCRIPTION
EC1718.2.4	Amendment in Final Level Sturcture and Approval of additional Open (Institute) elective – II Subject in semester VII (Annexure – IV)

ANNEXURE-IV

Organic Electronics
(Additional Open elective II)
CREDITS - 5 (L=L_3, T=T_0,P=P_2)
4^{th}Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To understand the concept of RF systems, various wireless protocols and its applications related to electronics& communication.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
L_3	T_0	P_2	C_5	ESE_{70}	CE_{30}	ESE_{30}	CE_{20}	$Total_{150}$

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Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Introduction to RF & Wireless Technology:** Introduction, Complexity comparison, RF design – Multidisciplinary field, Applications, Analog and Digital Systems, Choice of technology.	04	12
2	**Evolution of Mobile Communication Systems:** Brief history of mobile communications, Advantages and disadvantages of mobile communications, wireless network generations, Comparison of wireless systems, applications of wireless communications.	06	16
3	**Mobile communication engineering:** Introduction, Radio paths, Propagation attenuation, Basic propagation CDMA 2000 technology. 4G-LTE.mechanisms, mobile radio channel, simulation of wireless fading channels, free space propagation model, indoor propagation model, outdoor propagation model.	08	18
4	**GSM & CDMA Systems:** GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, CDMA architecture.	12	20

Unit No.	Topics	Teaching Hours	Weightage (%)
5	**3G and 4G Digital Mobile Technology :** 2.5G TDMA evolution path, GPRS technology, EDGE technology, 2.5G CDMA technology, Need of 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, W-CDMA air interface, TD-SCDMA technology,	09	18
6.	**Emerging Wireless Network Technologies:** IEEE 802.11 WLAN technology, IEEE 802.15 WPAN technology, IEEE 802.16 WMAN technology, Mobile adhoc networks (MANETs), Wireless sensor networks, RFID technology, IEEE 802.21 standards overview.	06	16
	Total Hours	45	100

List of References:

1. T. L. Singal, *"Wireless Communications"*,2nd Edition ,McGraw Hill Education Private Limited, 2011
2. A.Goldsmith,"*WirelessCommunications*",1st Edition,Cambridge university press, 2005
3. B. Razavi, "*RF Microelectronics*", 1st Edition,PHI, 1998
4. W.C.Y.Lee, *"Mobile Communications Engineering"*,2nd Edition,McGraw Hill Telecomm, 1998

Course Outcomes (COs):

By learning this course students will be able to …

7. Understand the RF &wireless communication systems and its standards.
8. Analyze and design the various indoor and outdoor mobile propagation model.
9. Design the GSM wireless networks.
10. Evaluate and design the CDMA wireless networks.
11. Compare the 3G and 4G wireless technology.
12. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	2	3	2	2	2	3	3	2	1	1	2	3	3	3	2
CO.2	3	3	3	2	2	2	2	2	3	2	2	3	2	2	2
CO.3	3	3	2	2	2	2	3	2	2	2	2	3	1	2	1
CO.4	3	3	2	2	2	3	1	2	2	2	2	3	2	2	2
CO.5	3	3	2	2	2	3	2	2	3	3	2	3	2	2	2
CO.6	2	3	2	2	2	3	1	2	3	3	2	3	3	2	3
Average	2.67	3	2.17	2	2	2.67	2	2	2.33	2.17	2	3	2.17	2.17	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Part I:Using MATLAB Software various simulations are performed like Rayleigh and Ricean distribution function, various mobile radio propagation model, BER of various modulation technology etc.
3. Laboratory: Part II:Performance of experiments using GSM and CDMA Trainer kits.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation,Experiments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments**
3.	CO.3	**Exam,Assignments, Presentation,Experiments**
4.	CO.4	**Exam, Assignments, Presentation,Experiments**
5.	CO.5	**Exam, Assignment, Presentation,Experiments**
6.	CO.6	**Exam, Assignments, Presentation,Experiments**

AGENDA ITEM 5: EC1718.2.5

AGENDA	DESCRIPTION

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
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Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

EC1718.2.5	**To approve Industry Project Guideline for short listed Students of Final Level of UG Programme (Annexure -V)**

Annexure - V

Sr. No.	Expert Name	BoS	Suggestions & Approval.
1.1	Dr. B C Goradiya	EC BoS	Stated discussing industry project guideline
1.2	Dr. N.J Kothari , Dr. R.A Thakkar	EC BoS	Keep all IITs and NITs open for industry project include PRL and other government research organization for industry projects
1.3	All BoS experts.	EC BoS	Recommends stipend to be paid to students for industry projects, If company is ready to pay stipend.

INDUSTRY PROJECT
4th Year, B. Tech. (Electronics and Communication)

Course Guidelines :

1. The Indusry Project shall exclusively be carried out at Industries/Organizations/Premier Institutes .Student shall physically be present at Industry/Organization/Premier Institute etc.
2. The Project shall be offered as an optional subject in the 8th semester of the Respective programmes and the credits of the project shall be equal to the total credits of the 8th Semester.
3. The maximum number of the students permitted for the Project shall be decided based on applications received from the students,DAC committee will shortlist applications, after looking at criteria maximum no of students allowed for industry project should not be more than 50 % of total strength of students in the semester .
4. Allocation of the students to Industries/Organizations/Premier Institutes shall be based on Merit Marks (i.e. CPI of the student). Details of the offering / selection of the industries etc. shall be decided by the Departmental Academic Committee (DAC). Subsequently, it shall be approved by the Respective Board of Studies.

List of Industries/Organizations approved by BoS,EC

Sr. No	Name of Industry

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1	**Matrix Telecom Solutions** 19-GIDC,Waghodia Dist. Vadodara-391 760, India
2	**Aimtron Foundation**, 1/A G.I.D.C. Estate, 2nd Floor ,Waghodia, Vadodara - 391760,Gujarat
3	**System Level Solutions (India) Pvt. Ltd** Plot#32, Zone-D/4, Phase-1, GIDC Estate,New V.V. Nagar - 388 121 Gujarat, India.,Anand
4	**Einfochips** Ahmedabad,Gujarat
5	**Leons' Integrations** Plot No 150,"Integration House", Ayodhyanagar,V.I.P. Road, Kareli Baugh, Vadodara, Gujarat, 390018, India
6	**Streebo Solutions Pvt. Ltd** A Floor, Siddhi Vinayak Tower, Off S.G. Highway, Makarba, Ahmedabad, India – 380051
7	**Helios Solutions** **Address** : 802 Iscon Atria 2, Gotri Road, Vadodara-390021, Gujarat **Contact Person** : Mr. Jaimin Sarvan **Website** : www.heliossolution.in **Area of Project Support for EC students**: Mobile Application Development PHP and E commerce application development.
8	**HashMedia** Contact Person: Mr. Harshit Lalpura **Website**: http://hashmedia.in/ **Area of Project Support for EC students** : Mobile Application ,PHP and E commerce application development. Biometrics Security System
9	***Indian Space Research Organisation* (ISRO)** Satellite Road,Ahmedabad – 380015 **www.sac.gov.in**
10	***BISAG - Bhaskaracharya Intitute for Space Applications and Geo-informatics*** Near CH '0' Circle, Indulal Yagnik Marg, Gandhinagar-Ahmedabad Highway, Gandhinagar-382 007 Gujarat, India **bisag.gujarat.gov.in**
11	***Physical Research Laboratory (PRL)*** *Navrangpura,* *Ahmedabad - 380 009, India*

12	***Institute For Plasma Research (IPR)*** *Bhat Village,Near Indira Bridge* *Gandhinagar-382428* *Gujarat - INDIA* **www.ipr.res.in**

5. Minimum two guides shall be appointed for each project. Among them, at least one shall be from Industry/Organization/Premier Institute/other College in which the project is undergone.
6. Student will not accept any stipend from industry in which student is carrying out the project.
7. Internal Guide/s shall closely monitor the progress of the Project.
8. Maximum teaching load of a faculty for guiding any form of Project (Internal Guide/s) shall not be more than four hrs/wk. Senior faculty, preferably, should not be assigned more than two hours/week of project load.
9. Internal Guide/s will be by default internal examiner/s.
10. Internal Guide/s will be by default internal examiner/s.
11. Each department shall appoint a course-coordinator to coordinate all projects.
12. The student/s shall present his/her/their progress of the project at-least two times in a semester as part of continuous evaluation. The presentation shall be evaluated by a committee formed by the DAC. The committee shall comprise of at-least two Faculty members from the same area, of the department, as well as the guide/s. The convener of the committee shall be a faculty other than guide/s of the student/s.
13. At the end of each semester, the Project shall be evaluated by the guide/s (internal examiner/s) and external examiner/s.
14. Distribution of marks for a Project in a semester shall be as follows.

Continuous Evaluation (CE)	End Semester Examination (ESE)
40 Marks	60 Marks
Assessed in two presentations by the Committee suggested in point no. 12. Each evaluator has equal weightage in Assessment.	Assessed in the presentation made by the student at the end of semester by internal Examiner/s and external examiner/s. Internal examiner/s shall award 50% of ESE marks and external examiner/s shall award 50% of ESE marks.

15. It is suggested that each Project is unique and shall be graded individually. Hence histogram shall be prepared for the Project. The guide line for grading the Project shall be made available in due course of time.
16. The inter-disciplinary projects are also encouraged.

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Note: The point nos. 8 to 15 are to be proposed for the approval of the Academic Council of BVM. And hence, respective BOS are not supposed to alter them.

AGENDA ITEM 6: EC1718.2.6

AGENDA	DESCRIPTION
EC1718.2.6	**To review of 1st year autonomous structure specially subjects like engineering graphics and reduce credits of Elements of mechanical Engineering and Basic civil engineering ,increasing credits of Fundamental of Electronics subject of first Level of UG Pragramme (Annexure -VI)**

Annexure - VI

SR. No.	Course Code	Sem	Course Title	Current Credit Structure	Proposed Credit structure
1.	CC111	I	Basic Civil Engineering	4(L) + 2 (P) = 6	3(L) + 2 (P) = 5
2.	CC141	I	Fundamental of Electronics	3 (L) + 2 (P) = 5	4(L) + 2 (P) = 6
3.	CC152	I	Elements of Mechanical Engineering	4 (L) + 2 (P) = 6	3(L) + 2 (P) = 5
4.	CC151	II	Engineering Graphics	2(L) + 4 (P) = 6	To be removed and to be added new subject of dept of 6 credit.

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Board of Studies Meeting

Annexure –VII

1. Following BoS,EC members were present in the meeting :

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. B. C. Goradiya	Professor,EC,BVM	Chairman
2	Prof. K. R. Patel	Asst.Professor,EC,BVM	Secretary
3	Prof. A. B. Bambhaniya	Asst. Professor,EC,BVM	Faculty Member
4	Prof. P. S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member
5	Prof. D. C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member
6	Prof. H. J. Patel	Asst.Professor,EC,BVM	Faculty Member
7	Prof. R. P. Paul	Asst. Professor,EC,BVM	Faculty Member
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member
9	Prof. R. M. Patel	Asst. Professor, EC, BVM	Faculty Member
10	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
11	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member
12	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
13	Prof. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
14	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
15	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
16	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member
17	Dr. R. A. Thakkar	Head and Professor EC Department, VGEC,Chandkheda,Ahmedbad	V.C Nominee
18.	Dr. N. J. Kothari	Head & Professor EC Department, DDU,Nadiad ,Gujarat	Member – Nominated by Academic Council

19.	Mrs. Ekata Mehul	Director Operations Aimtron Foundations, Waghodiya,Vadodara,Gujarat	Member – Nominated by Academic Council
20.	Er. N. N. Soni	SDE (NGN SWITCH) BSNL,Ahmedabad, Gujarat,india	Representative from industry related to placement
21.	Er. Krunal Patel	Project manager , SLS,Anand,Gujarat	Representative from industry related to placement
22.	Er. Meet Shah	Einfochips Sr. DevOps Engineer (DevOps Lead) Ahmedabad,Gujarat	Meritorious Alumni

2. Following Members were unable to attend the meeting.

Sr. No.	Name of Member	Designation	Role in BoS
1.	Dr. Dhaval K. Patel	Faculty Associate (Senior Lecturer) Institute of Engineering & Technology, ICT Department Ahmedabad,Gujarat	Member – Nominated by Academic Council

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ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA

Date: 24 -2-2018

Meeting of Board of Studies for Electronics & Communication Engineering Programme

Members of Board of Studies

Sr. No.	Name of Member	Designation	Role in BoS	Sign
1	Dr. B.C.Goradiya	Professor, EC, BVM	Chairman	
2	Prof. K.R. Patel	Asst.Professor,EC,BVM	Secretary	
3	Prof. A. B. Bambhaniya	Asst. Professor,EC,BVM	Faculty Member	
4	Prof. P.S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member	
5	Prof. D.C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member	
6	Prof. H.J. Patel	Asst. Professor,EC,BVM	Faculty Member	
7	Prof. R.P. Paul	Asst. Professor,EC,BVM	Faculty Member	
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member	
9	Prof. R.M. Patel	Asst. Professor, EC, BVM	Faculty Member	
10	Prof. P.K. Patel	Asst. Professor, EC, BVM	Faculty Member	
11	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member	
13	Prof. R.C.Rana	Asso. Professor, EC, BVM	Faculty Member	
14	Prof. A.H. Choksi	Asst. Professor, EC, BVM	Faculty Member	
15	Prof. R.R. Vashi	Asst. Professor, EC, BVM	Faculty Member	
16	Prof. M.M. Sevak	Asst. Professor, EC, BVM	Faculty Member	
17	Dr. R. A. Thakkar	Head & Professor, Electronics & Communication Department, VGEC, Chandkheda, Ahmedabad	V.C Nominee	
18	Dr. N. J. Kothari	Head & Professor Electronics and Communication Department,DDU,Nadiad	Member nominated by Academic	

(PTO) Page 1 of 2

ELECTRONICS & COMMUNICATION DEPARTMENT
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ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA
Date: 24 -2-2018
Meeting of Board of Studies for Electronics & Communication Engineering Programme

		,Gujarat	council	
20	Er. N. N. Soni	NGH SDE (~~EWSD SWITCH~~) ,BSNL,Ahmedabad	Representative from Industry related to placement	Nikunj Soni
21	Mrs. Ekata Mehul	Director Operations Aimtron Foundation, 1/A G.I.D.C. Estate, 2nd Floor ,Waghodia, Vadodara-391760,Gujarat	Member nominated by academic council	Ekata
22	Dr. Dhaval K. Patel	IET – Ahmedabad University	Member nominated by academic council	—ABSENT—
23	Er. Krunal Patel	Project Manager , System Level Solutions ,Anand	Industry Representative	
24.	Er. Meet Shah	Sr. DevOps Engineer (DevOps Lead) Einfochips, Ahmedabad	Meritorious alumni	24/2/18

HOD
Electronics & Communication Engg. Dept.
Birla Vishvakarma Mahavidhyalaya
Engg. College
Vallabh Vidyanagar-388120.

HOD

Electronics & Communication Engg. Dept.
Shri. Vishwakarma Maharudrayadaya
Engg. College
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Meeting of **BoS** of Electronics & Communication Engineering Branch, BVM (Autonomous), was held at **10:00 AM** on **Date: 18- 07-2018** for the following agenda items :

Agenda of the Meeting

EC1819.1.1 To discuss, suggest and approve Revised First Level Sturcture and detail syllabus of First Level of UG Programme. (Annexure – I)

Following suggestions and decisions were taken anonymously with regards to the agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
1.1	Dr. B C Goradiya	EC BoS	Started discussion of Revised first level Teaching Structure after reviewing subjects offered in AICTE Curriculam guideline Volume – I .
1.2	Dr. B C Goradiya and Dr. S. R. Unadkat	EC BoS	They suggested to introduce Semiconductor physics subject inplace of physics (3L:0T:2P = credits – 4 ,Prepared by Prof. S R Unadkat) with optimize contents .He also discuss syllabi in detail ,later on he suggested few modification and approved subject.
1.3	Dr. B C Goradiya	EC BoS	Basic Electrical Engineering will be offered by Electrical department .
1.4	Dr. B C Goradiya & other BoS Members	EC BoS	We can offer "Introduction of EC Engineering" Course which include vision,mission,PEOs,PSOs,scope,Courses,lab information ,Library facilities ,Job opportunities/career ,research domain /projects/opportunities, innovations, professional Societies etc. Later on after discussing syllabi in detail ,he approved syllabi. He also suggested that this Course can be also offer in other programme with desired Modification.
1.5	Dr. B C Goradiya	EC BoS	Electronics workshop will be offered by Electronics department.
	Dr. B C Goradiya	EC BoS	He started discussing detail syllabi of Basic Electronics Subject as Basic Science Course.He

			suggested to add few BJT and Opamp Apps ,Oscillator contents . Later on he approved the syllabi.
1.6	Dr. B C Goradiya	EC BoS	He suggested to offer "Programming for Problem Solving" Course by Computer Science Department.
1.7	Dr. B C Goradiya	EC BoS	Started Discussing syllabi of new Course - Introduction to Digital Electronics (Made by Prof. D.C. Dalwadi) in detail.He suggested to make changes in total hours as 12 for 1 hour tutorial. He suggested to add book of S. Salivahanan, "Digital circuits and Design", Vikas Publishing House .He suggested to consider subject as ESC – Engineering Science Course.Later on he approved subject.
1.8	Prof. D.C. Dalwadi	EC BoS	Introduction to Digital Electronics Syllabi has been made to introduce basics fundamental concepts like number systems ,logic gates and Boolean functions.
1.9	Dr. B C Goradiya	EC BoS	We should offer "Environmental Science " Subject as mandatory and Non credit Course.

AGENDA ITEM 1: EC1819.1.1

AGENDA	DISCRIPTION
EC1819.1.1	To discuss, suggest and approve Revised First Level Teaching Sturcture and detail Syllabus of First Level Subjects of UG Programme. (Annexure – I)

Annexure – I

Revised Programme Structure (Proposed and Approved by EC,BoS) for **First Level** of UG Programme under BVM Autonomous w.e.f Academic Year: 2018-19

SEMESTER I

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Sr. No.	Course category	Course taken by or offered by BoS	Course Title	Hours per week			Credits
				L	T	P	C
	Mandatory		Induction program of 3 weeks				
1	BSC	EC BoS	Semiconductor Physics	3	0	2	4
2	BSC	Maths BoS	Mathematics – I	3	1	0	4
3	ESC	EE BoS	Basic Electrical Engineering	3	0	2	4
4	HSMC	EC BoS	Introduction of EC Engineering	0	0	2	1
5	ESC	EL BoS	Electronics Workshop	0	0	2	1
6	HSMC	Maths BoS	English	2	0	2	3
7	Mandatory course	Civil BoS	Environmental Science (Non Credit Course)	2	0	0	-
			Total Hours per week and Credits	13	1	10	17

SEMESTER II

Sr. No.	Course category	Course taken by or offered by BoS	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	EC BoS	Basic Electronics	3	0	2	4
2	BSC	Maths BoS	Mathematics – II	3	1	0	4
3	ESC	CP BoS subject will be taken by EC dept	Programming for Problem Solving	3	0	2	4
4	ESC	ME BoS	Engineering Graphics	2	0	4	4
5	ESC	ME BoS	Manufacturing practice	0	0	2	1
6	ESC	EC BoS	Introduction to Digital Electronics	1	0	2	2
			Total Hours per week and Credits	12	1	12	21

Course Title: Semiconductor Physics
Basic Science Course
CREDITS = 4 ***(L=L_3, T=T_0, P=P_2)***

***1st* Year, B. Tech. (*Electronics and Communication*)**

Course Objective:
To understand the fundamentals of basic semiconductor physics which includes the Conducting materials, Electronic materials, Semiconductors, laser and Optical Fiber.

Teaching and Assessment Scheme:

Teaching Scheme				Assessment Scheme		
L	T	P	C	Theory	Practical	Total

				ESE	CE	ESE	CE	Marks
3	0	2	4	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Content:

Unit No	Topic	Teaching Hours	Weightage %
1	**Conducting Materials:** Introduction, Conduction in Metal, Free electron theory (Drude – Lorentz Theory), Electrical Conductivity, Thermal Conductivity ,Wiedemann – Franz Law, Lorentz number, Drawbacks of Classical free electron theory	6	20
2	**Electronic Materials:** Energy band Formation, Density of states and energy band diagram, Fermi Distribution Function, Thermionic Emission, Direct and indirect band gap Types of electronic materials, Metal Semiconductor and insulator, Occupation Probability, Effective Mass ,Phonons	8	20
3	**Semiconductors:** Introduction, Intrinsic Semiconductors, Dependence of Fermi Level on Carrier – concentration and Temperature In Intrinsic Semiconductors, Dependence of Fermi Level on Carrier – concentration and Temperature In Intrinsic Semiconductors, Mobility and Conductivity, Determination of band gap. Introduction, Extrinsic Semiconductors, Expression for Carrier concentration in n-type and p- type Semiconductor, Variation of Fermi level with temperature and impurity concentration, Hall effect, Determination of Hall coefficient	10	20
4	**LASER and Optical Fiber** **Laser:** Introduction, Properties of laser, Einstein's Theory of Matter Radiation: A and B Coefficients, Amplification of Light by Population inversion, Solid State lasers (Nd:YAG), Properties of Laser radiation; Coherence, Intensity, mono-chromaticity,	8	20

	Directionality, Applications of Laser in Science engineering and medicines. **Optical Fiber** Introduction, Advantages of optical fiber cable over metallic cable, Basic principle of total internal reflection, Acceptance Angle and Numerical Aperture, Types of Optical Fiber.		
5	**Measurements:** Four Probe and Van Der Pauw measurements for carrier density resistivity and hall mobility, Capacitance – Voltage measurements , Band gap by UV-VIS spectroscopy, Absorption, Transmission, Photovoltaic Effect, Exciton, Drude Model, Ultrasonic Measurements	6	20
	Total Hours	40	100

List of References :

1. Engineering Physics by G Vijayakumari, Vikas Publication, 2014
2. Semiconductor Devices: Physics and Technology by S. M. Sze, Wiley 2008
3. Applied Physics for Engineers by Neeraj Mehta, PHI 2011.
4. Engineering Physics By V Rajendran, McGraw Hill 2013
5. Engineering Physics by M K Harbola. Cengage Learning; 2 edition (2013)
6. Engineering Physics by M N Avadhanulu and P G Kshirsagar, S chand
7. J. Singh, Semiconductor optoelectronics: Physics and Technology, McGraw Hill Inc. (1995)
8. S M Sze, Semiconductor Devices: Physics and Technology, Wiley(2008)
9. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2008)
10. P Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997)
11. Online courses: Semiconductor Optoelectronics, by M R Shenoy on NPTEL
12. Online Course; Optoelectronic Materials and Devices by Monica Katiyar and Deepak Gupta on NPTEL.

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	50	20	-	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The

actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Understand the concepts of basic semiconductor physics and its development.
2. Understand the basics of band theory and its formation in solid.
3. Understand the fundamentals of various semiconducting materials.
4. Understand the working principle of a Laser components and working of different Laser system and their engineering applications.
5. Apply the elementary understanding to the measurement techniques.
6. Apply the basic formulas and solve engineering problems related to Semiconductor Physics.

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos etc.

2. Laboratory : Available Trainer Kits.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation,Experiments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments**
3.	CO.3	**Exam, Assignments, Presentation,Experiments**
4.	CO.4	**Exam, Assignments, Presentation,Experiments**
5.	CO.5	**Exam, Assignments, Presentation,Experiments**
6.	CO.6	**Exam, Assignments, Presentation,Experiments**

List of Experiments : (At Least 10 Experiment based on available trainer kits)

1. Introduction to Lab
2. Error Analysis in Physical Measurements
3. Hall Effect measurements for carrier concentration, mobility and type.
4. Optical Fiber for measurement of Numerical Aperture and Acceptance Angle
5. Band gap measurement using Four Probe Method
6. Study of I-V characteristic and Power Curve for Solar Cell
7. Dielectric Constant measurement
8. Ultrasonic Interferometer- to determine the velocity of sound in liquid.
9. Young's Modulus to measure the elasticity of the sample.
10. Least Square Fitting.

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Gujarat, India

Course Title : Introduction to Electronics and Communication Engineering
Course Category : Humanities and Social Science including Management
CREDITS - 1 (L=L_0, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective :

This course facilitates the students to get a comprehensive exposure to electronics and communication engineering.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	-	-	30	20	50

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Introduction** : History of major inventions in electronics and communication Engineering, Overview of various specializations in ECE.	4	15
2.	**Department Vision, Mission** : Introduction to institute and dept vision and mission, PEOs. PSOs, POs, COs and OBE	4	15

Unit No.	Topics	Teaching Hours	Weightage (%)
3.	**Future Scope :** Career opportunities, Avenues for higher studies in India and abroad, In plant training, Internships, Distinguished alumni in India and Abroad	4	15
4.	**Industries and R& D :** List of Industries and R & D institutions in India Category wise and domain wise.	4	20
5.	**Library :** Introduction to library facility in EC department and central library and other institutes, National and International journals, accessing digital library: Science direct and IEEE Explore, e-books and learning resources in the intranet and internet like MOOC through NPTEL and Webinar.	4	20
6.	**Departmental Facilities :** Brief overview of curriculum, laboratories and various software packages, electronic testing and measuring equipments, Specification for electronic components, Mini projects, Technical report preparation	4	15
	Total Hours	24	100

List of References:

***Books are not required**

Lecture notes prepared by Department of Electronics and Communication Engineering

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**50**	**20**			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Gujarat, India

Course Outcomes (COs):
By learning this course students will be able to …

1. Understand the scope and need of electronics and communication engineering.
2. Understand importance of vision, mission, PEOs, PSOs and COs, POs
3. Identify the list of R&D institutions, PSUs and Private industries in the domain of EC.
4. Recognize the standard books, reputed Journals and Magazine in the domain of EC.
5. Know the departmental technical resources.

Course title: Basic Electronics
Course Category: Basic Science Course
CREDITS - 4 (L=L_3, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective :

1. The goal of this course is to introduce electronics components, basic principles, operation and applications of the analog building blocks like: Diode, Bipolar Junction transistor, MOSFETs and Op-amp etc for performing various functions.
2. The course aims to make the students familiar with principles of basic electronic components and devices used for different electronic applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

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Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Introduction to Electronics Components:** Passive Electronic Components: Resistor: Construction overview, color code, value identification, Types of resistors, ratings/specifications resistors, importance of ratings. Capacitors, structure, value identification, types of capacitors, ratings/specification of capacitor, Inductors: structure, important applications of passive components. Active Electronic Components: Diodes, Transistor BJT, FET, MOSFET, CMOS identification of components and classification.	6	12
2.	**Diodes and its Applications:** Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters, clipper and clamper circuits; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode.	12	30
3.	**Bipolar Junction Transistors(BJT):** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Current-Voltage Characteristics, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration. Transistor as switch. Introduction to Oscillators.	11	28
4.	**Field-Effect Transistor and MOSFETs:** Field Effect Transistor (FET) Introduction, Construction, Physical Operation, Current – Voltage Characteristics of Junction FET, working principle. Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits.	08	15
5.	**Operational Amplifiers:** Introduction, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, DC Imperfections, CMRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, The Inverting Configuration, The Non- Inverting Configuration, Op-amp Applications, Difference Amplifier, Integrators and Differentiators. Comparator	08	15
	Total Hours	45	100

List of References:

1. Soumitra Kumar Mandal, "*Basic Electronics*", 1st Edition, Tata McGraw Hill,2012
2. Santiram Kal ,"*Basic Electronics- Devices, Circuits and its Fundamentals*", Prentice Hall India,2002
3. Jacob Millman and Christos C. Halkias, "*Integrated Electronics*", Ninth Edition, Tata McGraw Hill Publication,2012
4. Albert Malvino and David J. Bates, "*Electronic Principles*", Seventh Edition, Tata McGraw-Hill,2013
5. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Tenth Edition, Pearson Publication,2009
6. N.N.Bhargava,D.C.Kulshreshtha,S.C.Gupta,"Basic Electronics and Linear Circuits,2/E,TMH,2013

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	50	20			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs):
By learning this course students will be able to …

1. Identify the functions and applications of electronics components in Engineering.
2. Understand the basic of semiconductor diodes and special diodes.
3. Develop circuits based on diodes and passive devices.
4. Understand fundamentals of BJTs and its applications.
5. Understand the FET, MOSFET, CMOS and OPAMP and it applications.

Course code: Introduction to Digital Electronics
Engineering Science Course

CREDITS - 2 (L=L_1, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To understand the concept of digital electronics, number systems, logic gates and Boolean functions.

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Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	2	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	**Viva [10]**
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Number Systems :** Binary System, Signed binary, Octal, Hexadecimal number, Gray Code, Binary arithmetic, one's and two's complements of the number, Mathematical operations of the number system – Addition, Subtraction etc., Conversion of the number system	05	40
2.	**Fundamentals of Digital Systems and Logic Gates :** Basics of digital signals, digital circuits, Logic Gates - AND, OR, NOT, NAND, NOR and Exclusive-OR operations.	03	20
3.	**Boolean Functions :** Boolean laws, DE Morgan laws, Min terms, Max terms, Simplification of logic functions using K-map, minimization of logical functions, Half adder circuits, Full adder circuits.	04	40
	Total Hours	12	100

Suggested specification table with marks (Theory)

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	50	25			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009
2. S. Salivahanan, "Digital circuits and Design",Vikas Publishing house,2012
3. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016
4. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the concept of number system.
2. Understand the working of logic families and logic gates.
3. Design and implementation of digital circuits using Boolean functions.

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures etc.

2. Laboratory: Design and implementation of digital circuits using trainer kits, bread board, digital ICs etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**
2.	CO.2	**Exam, Assignments, Presentation, Experiments**

3.	CO.3	**Exam, Assignments, Presentation, Experiments**

List of Experiments : (At least 10 experiments based on available trainer kits)

1. Getting Familiar with Digital IC tester.
2. To study operation of various logic gates AND, OR, NOT, NAND, NOR and EX-OR.
3. Configure diodes and transistor as logic gates for verification of truth table of logic gates.
4. To study NAND/NOR as universal gates.
5. To study about DeMorgan's theorem.
6. Reduce Boolean expression to its simplest possible form using Boolean laws and theorems and implement it using gates F = A'BC' + A'BCD + A'CD' + A'BCD' + ACD'.
7. Reduce the following Boolean function using K map and implement it using NAND gates. $F(A,B,C,D) = \sum (1,3,5,6,7,8,9,10,11,13,14,15)$
8. Design Half adder circuit and verify the truth table for each.
9. Design Full adder circuit and verify the truth table for each.
10. Design Full subtractor and verify the truth table for each.

Board of Studies Meeting

Annexure - II

1. Following BoS,EC members were present in the meeting :

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. B. C. Goradiya	Professor,EC,BVM	Chairman
2	Prof. K. R. Patel	Asst.Professor,EC,BVM	Secretary
3	Prof. A. B. Bambhaniya	Asst. Professor,EC,BVM	Faculty Member
4	Prof. P. S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member
5	Prof. D. C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member
6	Prof. H. J. Patel	Asst.Professor,EC,BVM	Faculty Member
7	Prof. R. P. Paul	Asst. Professor,EC,BVM	Faculty Member
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member
9	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member

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10	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member
11	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
12	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
13	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member

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ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA

Date : 19-7-2018

Meeting of Board of Studies for Electronics & Communication Engineering Programme

Board of the Meeting

Sr. No.	Name of Member	Designation	Role in BoS	Sign
1	Dr. B C Goradiya	Asso. Professor,EC,BVM	Chairman	
2	Prof. K. R. Patel	Asst.Professor,EC,BVM	Secretary	
3	Prof. A. B. Bambhaniya	Asst. Professor,EC,BVM	Faculty Member	
4	Prof. P.S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member	
5	Prof. D. C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member	
6	Prof. H. J. Patel	Asst. Professor,EC,BVM	Faculty Member	
7	Prof. Robinson Paul	Asst. Professor,EC,BVM	Faculty Member	
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member	
9	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member	
10	Dr. S R Unadkat	Asst. Professor, EC, BVM	Faculty Member	
11	Prof. A. A Vahora	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. R.C Rana	Asso. Professor, EC, BVM	Faculty Member	
13	Prof. Amit Chokasi	Asst. Professor, EC, BVM	Faculty Member	
14	Prof. R. R. Vasta	Asst. Professor, EC, BVM	Faculty Member	
15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member	

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Website: http://sis.hashmedia.in
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Meeting of **Board of Studies (BoS)** of Electronics & Communication Engineering Programme, BVM (Under Autonomous Scheme),was held at **2:30 PM** on **Date :** 29 – 12 - 2018 for the following agenda items,

Agenda of the Meeting

EC1819.2.1 To discuss and approve MoM of Previous BoS meeting held on 18.07.2018 for Revised Teaching Sturcture and Detail syllabus of First Level of UG Programme as per the New AICTE UG Curriculum.(Annexure – I)

EC1819.2.2 To discuss, Suggest and Approve Revised Teaching Sturcture and detail syllabus of Second Level of UG Programme as per the New AICTE UG Curriculum Guideline. .(Annexure – II)

EC1819.2.3 To Discuss, Suggest and Approve amendment in Teaching Structure of Third and Fourth Level of UG Programme. .(Annexure – III)

EC1819.2.4 Amendment in Various NPTEL Courses offered as alternate of Available programme electives or as additional Programme Electives. (Annexure – IV)

EC1819.2.5 To Approve Updated Industry Project Guideline for Short Listed Students of Final Level of UG Programme. (Annexure – V)

Following suggestions and decisions were made confidentially with regards to the Agenda of the meeting after detailed discussions in the meeting :

Sr. No.	Expert Name	BoS	Suggestions & Approval.
1.1	Prof. K. R. Patel	EC BoS	Today's meeting was started at 2:30 P.M instead of 10:30 A.M due to external expert members inconvenience in the morning slot on .
1.2	Prof. K. R. Patel	EC BoS	Dr. B. C. Goradiya and Our external experts had visited departmental lab facilities , discussed about future lab development in the department.
1.3	Dr. B. C. Goradiya	EC BoS	Started discussing MoM of Previous BoS meeting held on 18.07.2018 for Revised Teaching Sturcture and Detail syllabus of First Level of UG Programme as per the New AICTE UG Curriculum.(Annexure – I).
1.4	Dr. B. C. Goradiya & other BoS	EC BoS	As AICTE Guideline Focussing on Laboratory based education ,we have reduced our theory Courses to

	Members		3 credits (3 hour),We have offered separate Lab for most of the subjects.We are focusing on outcome based education (OBE),So we are offering OBE based Education.
1.5	Er. Nilesh Ranepura & Er. Krunal Patel	EC BoS	After discussing English subject syllabi,he advised to rename the title of "English" as "Soft Skills " or other proffered one .
1.6	Er. Nilesh Ranepura & Er. Krunal Patel	EC BoS	Students should improve Communication & Presentation Skills .he suggested to read English books,Magazine to improve English .
1.6	Dr. B. C. Goradiya	EC BoS	He discussed contents of New Subject - Introduction to EC department .Finally external experts had appreciated the Subject offering.
1.7	Prof. K. R. Patel	EC BoS	Finally MoM of revised first level w.e.f 2018-19 (odd Sem.) was approved by all members.
1.8	Dr. B. C. Goradiya	EC BoS	Started discussing revised structure and detail syllabus of Second level .Due to industry demands , We have included OOP & other NPTEL subjects like Java ,DBMS etc. Listed in NPTEL Courses .
1.9	Dr. B. C. Goradiya	EC BoS	We should offer "Environmental Science " Subject as mandatory and Non credit Course.
2.0	Er. Nilesh Ranepura & Er. Krunal Patel	EC BoS	Discussed to include 16 bit processor achitechture .They discussed microprocessor practical aspects, suggested to include assembly language programming.
2.1	Dr. B. C. Goradiya	EC BoS	Basic electronics contents are covered upto MOSFET .
2.2	Er. Nilesh Ranepura & Er. Krunal Patel	EC BoS	Contents and Books of Digital system design are ok.
2.3	Dr. B C Goradiya	EC BoS	He discussed contents of Professional soft skills .Also discussed about training given to students for soft skill improvement by experts.
2.4	Er. Nilesh Ranepura, Er. Krunal Patel	EC BoS	Started discussing Third level teaching structure .They appreciated mainly industrial automation Course & other courses. Finally they approved third level structure

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2.5	Er. Nilesh Ranepura & Er. Krunal Patel,Other BoS members	EC BoS	Started discussing Revised list of NPTEL Courses.Er. Nilesh Ranepura said few of the NPTEL Courses are not valuable to offer ,we should include industry oriented NPTEL courses.Er. Nilesh had emphasized on introduction to Photonics & few electronics related subjects.
2.6	Er. Nilesh Ranepura & Er. Krunal Patel	EC BoS	We should 8085,8051,AVR then ARM based courses.Cover hierarchical structure of microprocessor and Controller to make students productive.we should include CMOS Digital Integrated Circuits in SEM 5 and DSP in SEM – 6 ,We can also switch position of digital system design and satellite communication.
2.7	Prof. R.P. Paul	EC BoS	We have offered CMOS Digital Integrated Circuits in SEM 6 due to limitations of hours and credits .
2.8	Dr. B. C. Goradiya	EC BoS	Started discussing final level structure.
2.9	Er. Nilesh Ranepura	EC BoS	Discussed contents of Microwave Engineering, he said do we need this subject in SEM – 7.
3.0	Dr. B. C. Goradiya	EC BoS	We have Laboratory of Antenna and Microwave engineering .so we are offering the subject.
3.1	Er. Nilesh Ranepura	EC BoS	Include electronic product design & quality approaches.Our experts can come for expert lecture on product design.
3.2	Dr. B. C. Goradiya	EC BoS	We can Offer Guided Research course for 4 hour – 2 credits.
3.3	Dr. B. C. Goradiya ,Prof. H. J. Patel ,Er. Krunal Patel	EC BoS	Discussed about Virtual instrumentation Course.
3.4	Dr. B. C. Goradiya	EC BoS	Started discussing amendment in Industry Project Guideline .He discussed few new industry included in the List , he suggested amendment in industry project guideline marks Scheme as ESE – 60 % and CE – 40 %.

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AGENDA ITEM 1: EC1819.1.1

AGENDA	DISCRIPTION
EC1819.1.1	To discuss, suggest and approve Revised First Level Teaching Sturcture and detail Syllabus of First Level Subjects of UG Programme as per the AICTE Curriculam Guideline. (Annexure – I).

Annexure – I

Revised Programme Structure (Proposed and Approved by EC,BoS) for **First Level** of UG Programme under BVM Autonomous w.e.f Academic Year: 2018-19 (Odd Sem)

SEMESTER - I

Sr. No.	Course category	Course taken by or offered by BoS	Course Title	Hours per week			Credits
				L	T	P	C
	Mandatory		Induction program of 3 weeks				
1	BSC	EC BoS	Semiconductor Physics	3	0	2	4
2	BSC	Maths BoS	Mathematics – I	3	1	0	4
3	ESC	EE BoS	Basic Electrical Engineering	3	0	2	4
4	HSMC	EC BoS	Introduction of EC Engineering	0	0	2	1
5	ESC	EL BoS	Electronics Workshop	0	0	2	1
6	HSMC	Maths BoS	English	2	0	2	3
7	Mandatory course	Civil BoS	Environmental Science (Non Credit Course)	2	0	0	-
			Total Hours per week and Credits	13	1	10	17

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SEMESTER II

Sr. No.	Course category	Course taken by or offered by BoS	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	EC BoS	Basic Electronics	3	0	2	4
2	BSC	Maths BoS	Mathematics – II	3	1	0	4
3	ESC	CP BoS subject will be taken by EC dept	Programming for Problem Solving	3	0	2	4
4	ESC	ME BoS	Engineering Graphics	2	0	4	4
5	ESC	ME BoS	Manufacturing practice	0	0	2	1
6	ESC	EC BoS	Introduction to Digital Electronics	1	0	2	2
			Total Hours per week and Credits	12	1	12	21

Course Title: Semiconductor Physics
Basic Science Course
CREDITS = 4 ***(L=L3, T=T0, P=P2)***

***1st* Year, B. Tech. (*Electronics and Communication*)**

Course Objective:

To understand the fundamentals of basic semiconductor physics which includes the Conducting
materials, Electronic materials, Semiconductors, laser and Optical Fiber.

Teaching and Assessment Scheme :

Teaching Scheme				Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	2	4	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component :

Term work [10]	Viva [10]

Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Content :

Unit No	Topic	Teaching Hours	Weightage %
1	**Conducting Materials:** Introduction, Conduction in Metal, Free electron theory (Drude – Lorentz Theory), Electrical Conductivity, Thermal Conductivity ,Wiedemann – Franz Law, Lorentz number, Drawbacks of Classical free electron theory.	6	20
2	**Electronic Materials:** Energy band Formation, Density of states and energy band diagram, Fermi Distribution Function, Thermionic Emission, Direct and indirect band gap Types of electronic materials, Metal Semiconductor and insulator, Occupation Probability, Effective Mass ,Phonons	8	20
3	**Semiconductors:** Introduction, Intrinsic Semiconductors, Dependence of Fermi Level on Carrier – concentration and Temperature In Intrinsic Semiconductors, Dependence of Fermi Level on Carrier – concentration and Temperature In Intrinsic Semiconductors, Mobility and Conductivity, Determination of band gap. Introduction, Extrinsic Semiconductors, Expression for Carrier concentration in n-type and p- type Semiconductor, Variation of Fermi level with temperature and impurity concentration, Hall effect, Determination of Hall coefficient	10	20
4	**LASER and Optical Fiber** **Laser:**	8	20

	Introduction, Properties of laser, Einstein's Theory of Matter Radiation: A and B Coefficients, Amplification of Light by Population inversion, Solid State lasers (Nd:YAG), Properties of Laser radiation; Coherence, Intensity, mono-chromaticity, Directionality, Applications of Laser in Science engineering and medicines. **Optical Fiber :** Introduction, Advantages of optical fiber cable over metallic cable, Basic principle of total internal reflection, Acceptance Angle and Numerical Aperture, Types of Optical Fiber.		
5	**Measurements:** Four Probe and Van Der Pauw measurements for carrier density resistivity and hall mobility, Capacitance – Voltage measurements , Band gap by UV-VIS spectroscopy, Absorption, Transmission, Photovoltaic Effect, Exciton, Drude Model, Ultrasonic Measurements	6	20
	Total Hours	40	100

List of References :

1. Engineering Physics by G Vijayakumari, Vikas Publication, 2014
2. Semiconductor Devices: Physics and Technology by S. M. Sze, Wiley 2008
3. Applied Physics for Engineers by Neeraj Mehta, PHI 2011.
4. Engineering Physics By V Rajendran, McGraw Hill 2013
5. Engineering Physics by M K Harbola. Cengage Learning; 2 edition (2013)
6. Engineering Physics by M N Avadhanulu and P G Kshirsagar, S chand
7. J. Singh, Semiconductor optoelectronics: Physics and Technology, McGraw Hill Inc. (1995)
8. S M Sze, Semiconductor Devices: Physics and Technology, Wiley(2008)
9. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2008)

10. P Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997)
11. Online courses: Semiconductor Optoelectronics, by M R Shenoy on NPTEL
12. Online Course; Optoelectronic Materials and Devices by Monica Katiyar and Deepak Gupta on NPTEL.

Suggested Specification table with Marks (Theory) :

Distribution of Theory %					
R Level	U Level	A Level	N Level	E Level	C Level
30	50	20	-	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate
C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers.
The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs) :
At the end of this course students will be able to …

1. Understand the concepts of basic semiconductor physics and its development.
2. Understand the basics of band theory and its formation in solid.
3. Understand the fundamentals of various semiconducting materials.
4. Understand the working principle of a Laser components and working of different Laser system and their engineering applications.
5. Apply the elementary understanding to the measurement techniques.
6. Apply the basic formulas and solve engineering problems related to Semiconductor Physics.

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos etc.
2. Laboratory : Available Trainer Kits.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation,Experiments**
2.	CO.2	**Exam, Assignments, Presentation,Experiments**
3.	CO.3	**Exam, Assignments, Presentation,Experiments**
4.	CO.4	**Exam, Assignments, Presentation,Experiments**
5.	CO.5	**Exam, Assignments, Presentation,Experiments**
6.	CO.6	**Exam, Assignments, Presentation,Experiments**

List of Experiments : (At Least 10 Experiment based on available trainer kits)

1. Introduction to Lab
2. Error Analysis in Physical Measurements
3. Hall Effect measurements for carrier concentration, mobility and type.
4. Optical Fiber for measurement of Numerical Aperture and Acceptance Angle
5. Band gap measurement using Four Probe Method
6. Study of I-V characteristic and Power Curve for Solar Cell
7. Dielectric Constant measurement
8. Ultrasonic Interferometer- to determine the velocity of sound in liquid.
9. Young's Modulus to measure the elasticity of the sample.
10. Least Square Fitting.

Course Title : Introduction to Electronics and Communication Engineering
Course Category : Humanities and Social Science including Management
CREDITS - 1 (L=L_0, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective :

This course facilitates the students to get a comprehensive exposure to electronics and communication engineering.

Teaching and Assessment Scheme :

ELECTRONICS & COMMUNICATION
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BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	-	-	30	20	50

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Introduction :** History of major inventions in electronics and communication Engineering, Overview of various specializations in ECE.	4	15
2.	**Department Vision, Mission :** Introduction to institute and dept vision and mission, PEOs. PSOs, POs, COs and OBE	4	15
3.	**Future Scope :** Career opportunities, Avenues for higher studies in India and abroad, In plant training, Internships, Distinguished alumni in India and Abroad	4	15
4.	**Industries and R& D :** List of Industries and R & D institutions in India Category wise and domain wise.	4	20

Unit No.	Topics	Teaching Hours	Weightage (%)
5.	**Library :** Introduction to library facility in EC department and central library and other institutes, National and International journals, accessing digital library: Science direct and IEEE Explore, e-books and learning resources in the intranet and internet like MOOC through NPTEL and Webinar.	4	20
6.	**Departmental Facilities :** Brief overview of curriculum, laboratories and various software packages, electronic testing and measuring equipments, Specification for electronic components, Mini projects, Technical report preparation	4	15
	Total Hours	24	100

List of References:

***Books are not required**

Lecture notes prepared by Department of Electronics and Communication Engineering

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**50**	**20**			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs) :
By learning this course students will be able to …

1. Understand the scope and need of electronics and communication engineering.

2. Understand importance of vision, mission, PEOs, PSOs and COs, POs
3. Identify the list of R&D institutions, PSUs and Private industries in the domain of EC.
4. Recognize the standard books, reputed Journals and Magazine in the domain of EC.
5. Know the departmental technical resources.

Course title: Basic Electronics
Course Category: Basic Science Course
CREDITS - 4 (L=L_3, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective :

1. The goal of this course is to introduce electronics components, basic principles, operation and applications of the analog building blocks like: Diode, Bipolar Junction transistor, MOSFETs and OP-amp etc for performing various functions.
2. The course aims to make the students familiar with principles of basic electronic components and devices used for different electronic applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	2	4	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component :

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Introduction to Electronics Components:** Passive Electronic Components: Resistor: Construction overview, color code, value identification, Types of resistors, ratings/specifications resistors, importance of ratings. Capacitors, structure, value identification, types of capacitors, ratings/specification of capacitor, Inductors: structure, important applications of passive components. Active Electronic Components: Diodes, Transistor BJT, FET, MOSFET, CMOS identification of components and classification.	6	12
2.	**Diodes and its Applications:** Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters, clipper and clamper circuits; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices - LEDs, Photo Diode.	12	30
3.	**Bipolar Junction Transistors(BJT):** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Current-Voltage Characteristics, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration. Transistor as switch. Introduction to Oscillators.	11	28

Unit No.	Topics	Teaching Hours	Weightage (%)
4.	**Field-Effect Transistor and MOSFETs:** Field Effect Transistor (FET) Introduction, Construction, Physical Operation, Current – Voltage Characteristics of Junction FET, working principle. Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits.	08	15
5.	**Operational Amplifiers:** Introduction, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, DC Imperfections, CMRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, The Inverting Configuration, The Non- Inverting Configuration, Op-amp Applications, Difference Amplifier, Integrators and Differentiators. Comparator	08	15
	Total Hours	45	100

List of References :

1. Soumitra Kumar Mandal, "*Basic Electronics*", 1st Edition, Tata McGraw Hill,2012
2. Santiram Kal ,"*Basic Electronics- Devices, Circuits and its Fundamentals*", Prentice Hall India,2002
3. Jacob Millman and Christos C. Halkias, "*Integrated Electronics*", Ninth Edition, Tata McGraw Hill Publication,2012
4. Albert Malvino and David J. Bates, "*Electronic Principles*", Seventh Edition, Tata McGraw-Hill,2013
5. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Tenth Edition, Pearson Publication,2009
6. N.N.Bhargava,D.C.Kulshreshtha,S.C.Gupta,"Basic Electronics and Linear Circuits,2/E,TMH,2013

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	50	20			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes (COs):
By learning this course students will be able to …

1. Identify the functions and applications of electronics components in Engineering.
2. Understand the basic of semiconductor diodes and special diodes.
3. Develop circuits based on diodes and passive devices.
4. Understand fundamentals of BJTs and its applications.
5. Understand the FET, MOSFET, CMOS and OPAMP and it applications.

Course code: Introduction to Digital Electronics
Engineering Science Course

CREDITS - 2 (L=L_1, T=T_0, P=P_2)

1st Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To understand the concept of digital electronics, number systems, logic gates and Boolean functions.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	2	70	30	30	20	150

Details of Assessment/Instruments under CE Practical Component:

Term work [10]	Viva [10]
Attendance/Lab File /Presentations	Experiment Performance/ Questions & Answers

Course Contents :

Unit No.	Topics	Teaching	Weightage

		Hours	(%)
1.	**Number Systems :** Binary System, Signed binary, Octal, Hexadecimal number, Gray Code, Binary arithmetic, one's and two's complements of the number, Mathematical operations of the number system – Addition, Subtraction etc., Conversion of the number system	05	40
2.	**Fundamentals of Digital Systems and Logic Gates :** Basics of digital signals, digital circuits, Logic Gates - AND, OR, NOT, NAND, NOR and Exclusive-OR operations.	03	20
3.	**Boolean Functions :** Boolean laws, DE Morgan laws, Min terms, Max terms, Simplification of logic functions using K-map, minimization of logical functions, Half adder circuits, Full adder circuits.	04	40
	Total Hours	12	100

Suggested specification table with marks (Theory)

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	50	25			

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009
2. S. Salivahanan, "Digital circuits and Design",Vikas Publishing house,2012
3. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016

4. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand the concept of number system.
2. Understand the working of logic families and logic gates.
3. Design and implementation of digital circuits using Boolean functions.

Delivery Methods:

1. Lectures : through Blackboard/ power-point slides, videos, pictures etc.

2. Laboratory : Design and implementation of digital circuits using trainer kits, bread board,

digital ICs etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exam, Assignments, Presentation, Experiments**
2.	CO.2	**Exam, Assignments, Presentation, Experiments**
3.	CO.3	**Exam, Assignments, Presentation, Experiments**

List of Experiments : (At least 10 experiments based on available trainer kits)

1. Getting Familiar with Digital IC tester.
2. To study operation of various logic gates AND, OR, NOT, NAND, NOR and EX-OR.
3. Configure diodes and transistor as logic gates for verification of truth table of logic gates.
4. To study NAND/NOR as universal gates.
5. To study about DeMorgan's theorem.
6. Reduce Boolean expression to its simplest possible form using Boolean laws and theorems and implement it using gates F = A'BC' + A'BCD + A'CD' + A'BCD' + ACD'.
7. Reduce the following Boolean function using K map and implement it using NAND gates. $F(A,B,C,D) = \sum (1,3,5,6,7,8,9,10,11,13,14,15)$
8. Design Half adder circuit and verify the truth table for each.

9. Design Full adder circuit and verify the truth table for each.
10. Design Full subtractor and verify the truth table for each.

Board of Studies Meeting

Annexure – II

1. Following BoS,EC members were present in the meeting :

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. B. C. Goradiya	Professor,EC,BVM	Chairman
2	Prof. K. R. Patel	Asst.Professor,EC,BVM	Secretary
3	Prof. A. B. Bambhaniya	Asst. Professor,EC,BVM	Faculty Member
4	Prof. P. S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member
5	Prof. D. C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member
6	Prof. H. J. Patel	Asst.Professor,EC,BVM	Faculty Member
7	Prof. R. P. Paul	Asst. Professor,EC,BVM	Faculty Member
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member
9	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
10	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member
11	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
12	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
13	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member

15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member

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ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHWAKARMA MAHVIDYALAYA

Date 18-7-2018

Meeting of Board of Studies for Electronics & Communication Engineering Programme

Board of the Meeting

Sr. No.	Name of Member	Designation	Role in BoS	Sign
1	Dr. B.C Goradiya	Asso. Professor,EC,BVM	Chairman	
2	Prof. K. R. Patel	Asst.Professor,EC,BVM	Secretary	
3	Prof. A. B Bambhaniya	Asst. Professor,EC,BVM	Faculty Member	
4	Prof. P.S. Bhakhar	Asst.Professor,EC,BVM	Faculty Member	
5	Prof. D. C. Dalwadi	Asso.Professor,EC,BVM	Faculty Member	
6	Prof. H. J. Patel	Asst. Professor,EC,BVM	Faculty Member	
7	Prof. Robinson Paul	Asst. Professor,EC,BVM	Faculty Member	
8	Prof. G. B. Rathod	Asst. Professor,EC,BVM	Faculty Member	
9	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member	
10	Dr. S R Unadkat	Asst. Professor, EC, BVM	Faculty Member	
11	Prof. A. A Vahora	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. R.C Rana	Asso. Professor, EC, BVM	Faculty Member	
13	Prof. Amit Choksi	Asst. Professor, EC, BVM	Faculty Member	
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member	
15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member	

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AGENDA ITEM 2 : EC1819.2.2

AGENDA	DESCRIPTION
EC1819.2.2	To discuss, Suggest and Approve Revised Teaching Sturcture and detail syllabus of Second Level of UG Programme as per the New AICTE Model Curriculum Guideline. (Annexture – II)

ANNEXTURE- II

Revised Programme Structure (Proposed and Approved) for **Second Level** of UG Programme under BVM (Autonomous) w.e.f Academic Year: 2019-20 (odd Sem)

HS = Humanities and Science, BS = Basic Science ,ES = Engineering Science, PC = Professional Core Courses , OE = Open Electives, PW/PROJ* = Project Work , Seminar and Intership, MC = Mandatory Non Credit Course.

Sr. No	Course Category Code	Name of Course	L	T	P	H	C
		Semester - III					
1.	BS	Advance Engineering Mathematics	3	0	0	3	3
2.	BS	Network Theory	3	1	0	4	4
3.	PC	Electronic Devices and circuits	3	0	0	3	3
4.	PC	Electronic Devices and circuits Lab	0	0	2	2	1
5.	PC	Digital System Design	3	0	0	3	3
6.	PC	Digital System Design Lab	0	0	2	2	1
7.	PC	Object Oriented Programming	3	0	0	3	3
8.	PC	Object Oriented Programming Lab	0	0	2	2	1
9.	ES	Simulation and Design Tools	0	0	2	2	1

10	HS	Professional Soft Skills	2	0	0	2	2
		Total	17	1	8	26	22
		Semester – IV	**L**	**T**	**P**	**H**	**C**
1.	PC	Signals & Systems	3	0	0	3	3
2.	PC	Signals & Systems Lab	0	0	2	2	1
3.	ES	Control Systems	3	0	0	3	3
4.	ES	Control Systems Lab	0	0	2	2	1
5.	PC	Analog Communication	3	0	0	3	3
6.	PC	Analog Communication Lab	0	0	2	2	1
7.	PC	Microprocessor and Computer Architecture	3	0	0	3	3
8.	PC	Microprocessor and Interfacing Lab	0	0	2	2	1
9.	PC	Electronic Measurements and Instruments	3	0	0	3	3
10.	PC	Electronic Measurements and Instruments Lab	0	0	2	2	1
11.	PW	Mini Project	0	0	2	2	1
		Total	15	0	12	27	21

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BS : NETWORK THEORY

CREDITS = 4 (L=3, T=1, P=0)
2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

The students will be familiar with the basic laws of Circuits and Network. The fundamental concepts of various theorems for electronics circuit network along with various transformations.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	1	0	4	60	40	-	-	100

Details of Assessment/Instruments under CE Thoery Component :

Internal Exam [30]	Continuous Assessment [10]
Mid Sem 1, Mid Sem 2, Remedial Exam	Assignments, Quiz, Presentations, Attendance

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Course Contents :

UNIT No.	Topics	Teaching	% Weightage
1.	**Introduction, Nodel and Mesh Analysis of Circuits :** Basic terminology and definitions related to networks, classification of networks, Kirchhoff's laws, Mesh Analysis of Circuits with Dependent and Independent Sources, Concept of Super mesh, Nodal Analysis of Circuits Containing Dependent and Independent Sources, Concept of Super node, Source Transformation technique, Mutual inductance, Dot convention for coupled circuits	8	20
2.	**Circuit Network Theorems :** Superposition Theorem, The venin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Substitution Theorem, Millman's Theorem, Application of above theorems in presence of dependent sources.	8	20
3.	**Time Domain Analysis& Transient Response of Linear Circuits :** Mathematical background, First order differential equations, Solution of Non-homogeneous equation using integrating factor, Time-constants, Second order equation, Solution of non-homogeneous differential equation,	7	15
4.	**Frequency Domain Analysis & Transient Response Of Linear Circuits :** Laplace transformation, Inverse Laplace transformation, Partial fraction expansion, Heaviside's Expansion theorem, The initial and final value theorem Sinusoidal transient analysis using Laplace transform methods, complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations.	8	15
5.	**Network Functions and Two port Network :** Poles and Zeros of the networks function, Restriction on Pole and Zero locations for driving point and transfer	8	20

	function. Two port Impedance parameters, Two port Admittance Parameters, Two port Hybrid parameters, and Two port Transmission parameters, Symmetry and Reciprocity of all parameters, Inter-relationship between all these parameters		
6.	**Network Topology and Synthesis :** Concept of Network Graph and Definitions, The Cut-set Matrix, The Tie-set Matrix, Kirchhoff's Laws in Fundamental Cut-set and Tie-set Matrix Basic synthesis procedure, Methods of synthesis, Driving point synthesis of one-port networks, synthesis of RLC driving point functions	6	10
	Total	**45**	**100**

Suggested specification table with marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	15	10	5

List of References :

1. Van Valkenburg, "*Network analysis*", PHI, 3rd Edition, 2007.
2. Franklin S. Kuo, "*Network Analysis & Synthesis*", Wiley India, 2nd Edition, 2010.
3. John O' Malley, "*Basic Circuit Analysis*", Schaum'series, TMH, 2/E, 2011.
4. De Carlo/Lin.,"*Linear Circuits Analysis*", Oxford University Press.,2nd Edition,2003.
5. A. Chakrabarti, "*Circuit Theory: Network analysis and Synthesis*", Dhanpat Rai & Co. Pvt.Ltd, 6th Edition, 2014.
6. U. A. Patel, "*Network Analysis*", Mahajan Publication, 3rd Edition, 2016

Course Outcomes (COs) :

By learning this course students will be able to …

1. Recollect the basic knowledge of various circuit laws and can perform its analysis.
2. Understand and Analyze behavior of passive circuits using the various circuit theorems.

3. Understand and Analyze behavior of passive circuits such as RC, RL and RLC.
4. Apply Laplace Transform for circuit analysis.
5. Calculate two port parameters such as y, z, h, ABCD and for that given two port network topologies
6. To design circuit graphs using network topology and also understand the synthesis techniques.

Course Articulation Matrix :

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)'-': Not correlated

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	3	2	1	1	3	--	--	1	--	1	3	2	2	1
CO.2	3	3	2	1	1	2	--	--	2	--	1	3	2	2	1
CO.3	3	3	2	1	2	2	--	--	2	--	2	3	2	1	1
CO.4	3	3	2	2	2	2	--	--	2	--	1	3	2	1	1
CO.5	3	3	2	2	3	2	--	--	1	--	1	3	2	1	2
CO.6	3	3	3	1	2	2	--	--	2	--	2	3	2	2	3
Avg:	3	3	2.1	1.3	1.8	2.1	--	--	1.6		1.3	3	2	1.5	1.5

Delivery Methods :

1. Lectures through Blackboard/ Power-point slides, videos, Pictures.

Constituent COs in Assessment Tools -

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

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PC -: Electronic Device and Circuits

CREDITS - 3 (L=L_3, T=T_0, P=P_0)

2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To familiarize students with small signal low and high frequency analysis on BJT circuits, and also with MOSFET building Block, Power amplifiers, various feedback & oscillators, Op-amp various parameters and its application, Signal Generators and Waveform-Shaping Circuits its applications.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Detail Syllabus:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Small Signal Frequency Analysis And Design:** • **Low Frequency Analysis:** Introduction, Amplification in the AC Domain, BJT Transistor Modeling, The Important Parameters: Z_i, Z_o, A_v, A_i ,The r_e Transistor Model, The Hybrid Equivalent Model, Graphical Determination of the *h*-parameters, Common-Emitter Fixed-Bias Configuration, Voltage-Divider Bias, CE-Emitter Bias configuration, Emitter-Follower Configuration, Common-Base Configuration. • **High Frequency Analysis:** Hybrid–pi CE transistor model, Hybrid–pi conductance, Hybrid–pi capacitances, Validity of hybrid–pi model, Variation of hybrid–pi parameters, CE short-circuit current gain, Current gain with resistive load, Single-stage CE transistor amplifier response, Gain-bandwidth product	15	20

2	**Building Blocks of Amplifiers:** Comparison of the MOSFET and BJT, IC Design Philosophy, The Basic Gain Cell, Cascade Amplifier, IC Biasing-Current Sources & Current Mirrors Circuits , Cascade Configurations: CC-CE, CD-CS, CD-CE, 10Darlington, CC-CB and CD-CG.	5	10
3	**Large Signal Amplifiers (Power Amplifier):** Introduction—Definitions and Amplifier Types, Series-Fed Class An Amplifier, Transformer-Coupled Class-A Amplifier, Class-B Amplifier Operation and Circuits, Amplifier Distortion, Class-C and Class-D Amplifiers.	5	20
4	**Operational Amplifiers & Application**: Introduction, Block Diagram representation of a typical op-amp, Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal Drift, Effect of variation in power supply voltages on offset voltage, Change in input offset voltage and input offset current with time, Other temperature and supply voltage sensitive parameters, Noise, Application: amplifiers , comparators, converters.	8	20
5	**Feedback And Oscillator Circuits:** Feedback Concepts, Feedback Connection Types (Voltage-Series, Voltage-Shunt, Current-Series, Current-Shunt), and The Important Parameters: Z_i, Z_o, A_v, A_i, Feedback Amplifier—Phase and Frequency Considerations. Oscillator Operation, Basic Principles of Sinusoidal Oscillators, Phase-Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuit, Crystal Oscillator, Unijunction Oscillator	7	20
6	**Signal Generators and Waveform-Shaping Circuits**: Generation of Square & Triangular Waveforms Using Astable Multivibrator, Bistable Multivibrator, Generation of a Standardized Pulse-The Monostable Multivibrator, Integrated-Circuit Timers, Nonlinear Waveform-Shaping Circuits, Precision Rectifier Circuits using 555 Timer IC. PLL and FLL, Phase and Frequency Followers, Frequency Locked Loop.	5	10
	Total Hours:	45	100

Suggested specification table with marks (Theory)

Distribution of Theory Marks in %					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Book:

1. Integrated Electronics, Millman Halkias (2011) 2nd Edition, McGraw hill.
2. Electron Devices and Circuit Theory, Robert Boylestad and Louis Nashelsky, (2008), 10th edition, Pearson Prentice Hall.
3. Microelectronic Circuits ,Sedra/Smith(2010),6th Edition, Oxford University,
4. Opamp and Linear Integrated Circuits, Ramakant A. Gaikwad (2009), 4th Edition, PHI.
5. Analog integrated circuit applications, J. Michael Jacob (200), Prentice Hall.
6. Electronic devices & circuits, David Bell, (2008), 5th Edition, Oxford Publications.

Course Outcomes (COs):

By learning this course students will be able to …

1. Understand & Analyze BJT circuits at low and high-frequency.
2. Design Building Blocks of Amplifiers.
3. Categorize various audio frequency power amplifier circuits and their comparison.
4. Study and measure various OPAMP parameters and its applications.
5. Design Feedback oscillator circuits.
6. Analyze Signal Generators and Waveform-Shaping Circuits and applications like PLL, FLL.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.1	3	2	2	1	1	1	-	-	1	-	-	3	3	1	1
PC.2	3	2	2	2	1	2	-	--	2	2	-	3	2	1	1
PC.3	3	2	1	1	1	2	-	-	2	2	1	3	2	1	1
PC.4	3	3	2	1	2	3	-	-	2	2	-	3	2	1	1
PC.5	3	2	2	1	1	3	-	-	2	2	2	3	2	1	1
PC.6	3	2	2	1	2	3	-	-	3	2	2	3	2	1	2
Average	3	2.16	1.83	1.16	1.33	2.33	-	-	2.0	1.66	0.83	3	2.16	1	1.16

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	PC.1	**Exam, Assignments, Presentation**
2.	PC.2	**Exam, Assignments, Presentation**
3.	PC.3	**Exam, Assignments, Presentation**
4.	PC.4	**Exam, Assignments, Presentation**
5.	PC.5	**Exam, Assignments, Presentation**
6.	PC.6	**Exam, Assignments, Presentation**

PC : Digital System Design

CREDITS - 3 (L=*3*, T=*0*, P=0)

2nd Year, B.TECH (Electronics & Communication)

Course Objective :

The students need to learn basic concepts of digital circuits and system which leads of complex digital system such as microprocessors. The student needs to know combinational and sequential circuits using digital logic fundamentals.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	-	-	100

Teaching and Assessment Scheme :

Term work [30]	Viva [10]
Mid semester - 1 , Mid semester – 2 Examination,Remedial Exam	Assignment /Quiz / Attendance

Course Contents :

Unit No.	Topics	Teaching Hours	% (Weightage)
1.	**Introduction to logic families :** Digital IC Specification Terminology, Positive and Negative Logic, Transistor transistor Logic, Open collector gates, Integrated Injection Logic, Emitter Coupled Logic, MOS Logic, COMS Logic.	04	10
2.	**Combinational Circuits:** 4-Bit Binary Parallel adder and Subtractor, BCD and EX-3 adder and Subtractor, CODE Converter, Parity Generator/Checker, Magnitude Comparator, Decoder/Encoder, Application of Decoder/Encoder, Multiplexer/De- Multiplexer , Application of Multiplexer/De- Multiplexer, Modular design using IC chips.	10	20

Unit No.	Topics	Teaching Hours	% (Weightage)
3.	**Sequential Circuits:** Latches and Flip-Flops, SR Flip-Flop, Edge-Triggered SR Flip-Flop, Edge-Triggered D Flip-Flop, Edge-Triggered T Flip-Flop, Flip-Flop Excitation Table, Conversion of Flip-Flop, Introduction to Shift Registers, Buffer Register, SISO,SIPO,PISO,PIPO Shift Register, Universal Sift Register. Asynchronous and Synchronous Counter, Design of Asynchronous Counter, Effect of Propagation Delay in Ripple Counter, Design of Synchronous Counter, Ring Counter and Twisted Ring Counter.	**12**	**20**
4.	**State Machines:** The finite state model: State diagram, State table, State reduction, State assignment, Transition and Output table, Excitation table. Memory Elements, Mealy and Moore machines representation, Implementation of serial binary adder , Sequence detector, Design counter using moore and melay type finite state machine.	**06**	**15**
5.	**Programmable Logic Device and Memories:** Introduction to Programmable Logic Device, Read Only Memory, Programmable Logic Array, Programmable Array Logic. The role of memory in a computer system, Memory types and terminology, Semiconductor RAMS, Memory expansion, Non-volatile RAMS, Sequential Memories, Magnetic Memories.	**08**	**20**

Unit No.	Topics	Teaching Hours	% (Weightage)
6.	**Analog to Digital and Digital to Analog converter:** Digital to Analog conversion, R-2R Ladder type DAC, Weighted- resister type DAC, Analog to digital conversion, Counter type ADC, Tracking type ADC, Flash type ADC, Dual slope type ADC, Successive approximation type ADC.	**05**	**15**
	Total Hrs.	**45**	**100**

Suggested specification table with marks (Theory)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	25	10	10	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. David J. Comer (1995), 3rd edition, "*Digital Logic and State Machine Design*", oxford university press.
2. M. Morris Mano , Michael D. Ciletti, 2009, 4th edition, "Digital Design", Pearson.
3. R.P. Jain, 2007 , 3rd edition "*Modern digital electronics*", TMH.
4. A. Anand Kumar, 4th edition, 2016, "*Fundamentals of digital circuits*", PHI.
5. B. Somanathan Nair,2006, 6th edition, Digital Electronics and Logic Design, PHI.

Course Outcomes (COs):

At the end of this course students will be able to

1. To understand various logic families and selection of logic families as per the application.
2. Detailed understanding of the fundamental concepts to design digital system.

3. The ability to understand, analyze and design various combinational circuits.
4. The ability to understand, analyze and design various sequential circuits.
5. To understand role of memory in computer system.
6. Understand the architectures of various data converters.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	1	1	1	1	-	-	-	-	-	-	3	-	-
CO.2	3	2	1	1	1	1	-	-	-	-	-	-	3	-	1
CO.3	3	2	1	2	1	1	-	-	-	-	-	-	3	-	1
CO.4	3	1	1	2	1	1	-	-	-	-	-	-	3	-	1
CO.5	3	1	1	1	1	1	-	-	-	-	-	-	3	-	1
CO.6	3	2	1	2	1	1	-	-	-	-	-	-	3	-	-

Delivery Methods:

1. Lectures through Blackboard, power-point slides, videos, animations, pictures, graphics etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	CO.1	**Exams, Assignments, Presentation**
2.	CO.2	**Exams, Assignments, Presentation**
3.	CO.3	**Exams, Assignments, Presentation**
4.	CO.4	**Exams, Assignments, Presentation**
5.	CO.5	**Exams, Assignments, Presentation**
6.	CO.6	**Exams, Assignments, Presentation**

ELECTRONICS & COMMUNICATION
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Gujarat, India

PC: Digital System Design Lab

CREDITS - 2 (L=L_0, T=T_0, P=P_2)

2nd Year, B. Tech. (Electronics & Communication)

Course Objective :

To Provide practical knowledge about Digital electronics for designing various Combinational and sequential circuits.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Teaching Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	-	-	40	60	100

CE Practical Component :

Lab work [30]	Lab work [30]
Practical File/Attendance/quiz/ lab work	Open ended problem/ team work/presentation skill/ report quality of the project

Sr. No.	LIST OF EXPERIMENTS:
1	To obtain frequency response single stage and 2-stage direct coupled transistor amplifier.
2	Plot the transfer and drain characteristics of n-channel J-FET and calculate its parameters, like, drain resistance, mutual conductance and amplification factor.
3	Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, like, drain resistance, mutual conductance and amplification factor.

Sr. No.	LIST OF EXPERIMENTS:
4	Build/test Transformer coupled class-A Power amplifier.
5	Determine the efficiency of class-B push pull power amplifier.
6	Use of the opamp (IC 741) as inverting and noninverting amplifier, adder, integrator, buffer, scale changer.
7	To measure the output offset voltage of an opamp (741) and zero adjustment using nulling techniques.
8	Study and design Differentiator and Integrator circuit with the help of Opamp.
9	Build/test Astable, Monostable, Bi-stable Multivibrator using IC 555 for different values of R and C.
10	To measure the relevant parameters of an IC phase-locked loop (PLL)
11	Identification of package types and terminals and familiarization with characteristics and ratings using various electronic devices like Schottky barrier diode, Zener diode-Varactor diode Tunnel diode, Thermistors, Gallium Arsenide device, LASER diode, LDR. UJT, SCR, DIAC, LCD, Photo transistor, Solar cell,photo transistor, photo diode, LED, LDR and photo Voltaic Cells **(Any Three)**
12	Build/test mini project

Course Outcomes (COs):

By learning this course students will be able to …

1. To understand various logic families and selection of logic families as per the application.
2. Detailed understanding of the fundamental concepts to design digital system.
3. The ability to understand, analyze and design various combinational circuits.
4. The ability to understand, analyze and design various sequential circuits.
5. To understand role of memory in computer system.
6. Understand the architectures of various data converters.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.1	3	2	1	1	1	1	-	-	-	-	-	-	3	-	-
CO.2	3	2	1	1	1	1	-	-	-	-	-	-	3	-	1
CO.3	3	2	1	2	1	1	-	-	-	-	-	-	3	-	1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO.4	3	1	1	2	1	1	-	-	-	-	-	-	3	-	1
CO.5	3	1	1	1	1	1	-	-	-	-	-	-	3	-	1
CO.6	3	2	1	2	1	1	-	-	-	-	-	-	3	-	-

Delivery Methods :
Laboratory : Performance of Experiments Using Digital Trainer kits, ICs, Bread boards. Consumable Items : Various logic ICs for logic gates, flip-flops, latch, decoders, encoders, multiplexers, de-multiplexer, comparator, shift resistor, etc., hook-up wires, Soldering iron, De - soldering pump, Electronics Toolkit, etc.

Open Ended Problem :

1) Gaming circuit which are useful to take decision on the basis of priority
2) Design a circuit for toys to control various parameter and indication
3) Digital clock with some innovative idea
4) Digital Alarm with some innovative idea
5) Sequential design to detect specific sequence of digital data.

Simulation and Design Tools

CREDITS - 1 (L = 0 , T = *0*, P = 2)

***2th* Year, B. Tech. (Electronics & Communication)**

Course Objective :

Introduce Simulation and Designing tools / software to design and simulate various Analog and digital circuits, and design PCB layout for the desired circuits using PCB design tools.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component :

Term work [30]	Lab work [30]
Lab File	Experimental Skills, Attendance , Quiz, Assignment

Course Contents :

Unit No.	Topics	Teaching Hours
1.	**Introduction to PSpice Software :** Introduction to PSpice software, General purpose circuit simulation using Schematic Editor, Introduction to net list command based SPICE simulation, basic net list commands. Basic circuit analyses: DC, AC Transient. Schematic design simulation using PROTEUS/OrCAD tool.	14
2.	**Introduction to PCB Design Software :** Introduction to PCB Design software, Schematic Entry, Net list Creation, Working with component libraries, Design of Boards, Layout of Parts, Optimizing Parts Placements, Pads and Via, Manual and Auto Routing, Handling Multiple Layers. Layout verification of test circuits using EAGLE/OrCAD tool.	08
3.	**Introduction to MATLAB :** Introduction to MATLAB, use MATLAB functions. Writing simple programs using MATLAB, handling arrays, files, plotting of functions etc. Writing m files for Creation of analog & discrete signals, plotting of signals etc. Simulation of electronic circuits using MATLAB.	08
	Total	30

List of References :

1. Rashid H. Muhammad, "*Introduction to Pspice Using Orcad for Circuits and Electronics*", 3rd edition, PHI, 2010.
2. Simon Monk, "*Make Your Own PCB's With EAGLE*", 2nd edition Mcgraw Hill ,2014
3. Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Kevin R. Coombes, John

E. Osborn, Garrett J. Stuck. "A guide to MATLAB: For beginners and experienced users" 2nd edition Cambridge University Press, 2006

Course Outcomes (Cos) :

At the end of this course students will be able to…

1. Design simple electronics circuits using software tools like PROTEUS/OrCAD.
2. Analyze simple analog and digital circuits using simulation software like PROTEUS/OrCAD.
3. Design PCB Layout for given circuit using PCB Software like EAGLE, OrCAD.
4. Analyze various MATLAB command.
5. Generate various waveforms using MATLAB.
6. Analyze basic electronic system blocks using MATLAB.

Course Articulation Matrix :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 13	PSO 14	PSO 15
ES.1	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
ES.2	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
ES.3	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
ES.4	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
ES.5	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
ES.6	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1
AV G.	3	3	2	1	3	1	-	-	3	-	-	2	2	3	1

Delivery Methods:

1. Laboratory exercises using Software tools like PROTEUS/OrCAD.
2. Presentation slides of different command of MATLAB

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	ES.1	**Exam,Assignments,Experiments**
2.	ES.2	**Exam,Assignments,Experiments**

3.	ES.3	**Exam,Assignments,Experiments**
4.	ES.4	**Exam,Assignments,Experiments**
5.	ES.5	**Exam,Assignments,Experiments**
6.	ES.6	**Exam,Assignments,Experiments**

OBJECT ORIENTED PROGRAMMING

CREDITS - 5 (L=*3*, T=*0*, P=*2*)

2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To learn the basics of C++, Objects and Classes, Inheritance, Polymorphism, I/O and file management, and advance topics including templates, exceptions and STL (Standard Template Library).

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				T		P		L
L	T	P	C	ESE	CE	ESE	CE	100
3	0	0	3	40	60	00	00	

Details of Assessment Instruments under CE Practical Component :

Internal Exam **[30 Mark]**	Continuous assessment **[10 Mark]**
Mid Sem 1 Exam , Mid Sem 2 Exam, Remedial Exam	Assignments/ Presentations/ Quiz etc. based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

Course Contents:

ELECTRONICS & COMMUNICATION
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Gujarat, India

Unit No.	Topics	Teaching Hours	Module Weightage
1	**Introduction to C++:** Introduction OOP, Procedural Vs. Object Oriented Programming, Basic concept of OOP, Principles of OOP, Benefits and applications of OOP, Programming in C++.	04	5 %
2	**Data types, Operators and Control Structures :** Data Types, Keyword, Tokens, identifiers, variables, constants,enum, operators, typecasting, control structures.	05	6 %
3	**C++ Functions :** Function Prototyping, Call by value and reference, Return by reference, Inline function and macro function, Default Arguments, Function Overloading.	05	8 %
4	**Class and Objects :** Structure V/s Class, Member functions Declaration, Access Specifier for member function, Static data Member and Member Function, Friend Function, Object as Argument.	07	15 %
5	**Constructor and Destructor :** Constructor, Types of Constructor, Destructor.	04	8 %
6	**Operator Overloading and Type Conversion :** Unary and Binary Operator Overloading, Types of Type Conversion.	04	10 %
7	**Inheritance :** Inheritance, Types of Inheritance, Virtual Base Classes, Abstract Class, Constructor in Derived Class	04	12 %
8	**Virtual Function and Polymorphism :** Polymorphism, Types of Polymorphism, this Pointer, Virtual Function, Pure Virtual Function	04	12 %

Unit No.	Topics	Teaching Hours	Module Weightage
9.	**I/O Functions & File Management :** Formatted and Unformatted I/O Operations, Manipulators, Classes for File Operations, Basic File Operations, File Functions, Error Handling Operations, Command Line Arguments.	04	12 %
10.	**Template and Exception Handling :** Template, Types of Template, Multiple Parameter in Class template and function template, Overloading of template function, Try, Catch and Throw, Multiple Catch, Rethrow Exception.	04	12 %
	Total	45	100 %

Suggested Specification Table with Marks (Theory) :

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
12	21	21	3	3	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers The actual distribution of marks in the question paper may vary slightly from above table.

List of References :

1. E Balagurusamy, *"Object Oriented Programming with C++"*, Tata McGraw Hill, 6th edition, 2013.
2. Bhushan Trivedi, *"Programming with ANSI C++"*, Oxford University Press, 2nd edition, 2013.
3. Herbert Schlitdt, *"C++ the Compete Reference"*, TMH Publication, 5th edition, 2014.
4. Ashok Kamthane, *"Object Oriented Programming with ANSI and Turbo C++"*, Pearson Education, 1st Edition, 2011.

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Gujarat, India

Course Outcomes (COs) :
By learning this course students will be able to …

1. Remember the basic programming concepts and the necessary constructs of C++ programming.
2. Understand algorithmic thinking and problem solving techniques.
3. Describe concepts like object and class, encapsulation, inheritance, polymorphism, template and exception handling for real life problems.
4. Apply advance features to make programs which supports reusability and sophistication.
5. Test standard template library for faster development.
6. Resolve C++ program using variables, operators, control structures, functions and objects.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	1	2	2	1	2	-	-	1	1	-	-	2	-	1	3
CO.2	2	3	3	2	2	1	-	2	1	-	-	2	-	1	3
CO.3	1	3	3	3	3	1	-	3	-	-	-	3	-	1	3
CO.4	1	3	3	3	3	1	-	2	-	-	-	3	-	1	3
CO.5	2	-	3	3	3	-	-	2	-	-	-	1	-	-	3
CO.6	3	3	3	3	3	1	-	3	1	-	-	2	-	-	3
Average	1.66	2.33	2.83	2.5	2.66	0.66	-	2.16	0.5	-	-	2.16	-	-	3

Delivery Methods :

Lectures through Blackboard, Power-point slides and online Compiler.

Object Oriented Programming Lab

CREDITS - 1 (L=0, T=0, P=2)

2nd Year, B. Tech. (*Electronics and Communication*)

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				T		P		L
L	T	P	C	ESE	CE		CE	

L_0	T_0	P_2	C_1	ESE_{00}	CE_{00}	ESE_{40}	CE_{60}	$Total_{100}$

Details of Assessment Instruments under CE Practical Component: (60 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance .

File	Attendance	Quiz	OEP	Experimental Skills	Total
10	10	10	20	10	60

List of Experiments :

Sr No.	SET-1 Basic C++ Programs
	How to Compile and Run C++ program in Ubuntu Linux?
1.	Write a program to print hello world on the screen.
2.	Write a program to read integer, float and string from the keyboard and display it on the screen.
3.	Write a program to find average of two numbers.
4.	Write a program to check whether number is even or odd .
5.	Write a program to make a simple calculator.
6.	Write a program that uses structure to store three parts of phone number separately.
7.	Write a program to implement concept of reference variable.
8.	Write a program to find sum of digits of a number.

9.	Write a program for function with default arguments to find the area of circle.
10.	Write a program to illustrate the concept of call by value and call by reference(swapping of two numbers).
11	Write a program to use the concept of scope resolution operator
12.	Write a program to implement concept of function overloading (area calculation).
13.	Write a program to implement function overloading to computer pow (m,n). case (1) m is integer and n is double, (2) m and n both are int .
	SET-2 Programs using Class and Objects
14.	Write a program to demonstrate declaration and initialization of object of class. (to print students age, name and sex).
15.	Write a program to demonstrate declaration and initialization of object of class. (Member function inside the class)
16.	Write a program to find smallest number out of two classes with help of class and object.
17.	Write a program to perform operation on string class(find length , compare two strings and join them).
18.	Write a program to find whether number is Armstrong or not using class and object.
19.	Write a program to implement concept of manipulator setw().
20.	Write a program to implement concept of explicit type casting.
21.	Write a program to find cubic values using inline function.
22.	Write a program to find factorial of given number (function recursion).
23.	Write a program to implement concept of math functions.
24.	Write a program to find the largest value out of two numbers using nesting of

	member functions.
25.	Write a program to implement nesting of member functions using class to find the 1's complement of given number.
26.	Write a program to process a shopping list.
27.	Write a program to implement concept of static class member.
28.	Write a program to implement concept of static member functions
29.	Write a program to implement concept of array of object.
30.	Write a program for addition of two time objects (objects as arguments) .
31.	Write a program to find mean value of given number using friend function.
32.	Write a program to add data objects of two different classes using friend functions
33.	Write a program to add two complex numbers using concept of returning objects.
34.	Write a program to implement friend function to two classes.
35.	Write a program to swap private data of two classes.
36.	Write a program to transpose 3x3 matrices by concept of returning objects.
37.	Write a program to add two numbers with the help of dereferencing operator.
38.	Write a program to implement concept of banking system.
	SET-2 Programs using Constructor and Destructor
39.	Write a program to implement concept of constructor and destructor.
40.	Write a program to check whether number is prime or not.
41.	Write a program to implement the concept of copy constructor.
42.	Write a program to calculate factorial of a given number using copy constructor.

43.	Write a program to implement concept of overloaded constructor.
44.	Write a program for dynamic initialization of constructor.
45.	Write a program to construct strings in objects using dynamic constructor.
	SET-3 Programs using Operator Overloading
46.	Write a program to implement concept of unary operator overloading.
47.	Write a program to implement concept of unary operator overloading using friend function.
48.	Write a program to implement concept of binary operator overloading.
49.	Write a program to implement concept of binary operator overloading using friend function.
50.	Write a program for multiplication of vector using operator overloading with friend function.
51.	Write a program to perform mathematical operations on strings.
52.	Write a program to add and multiply to matrix objects by overloading + and * operators using friend functions
53.	Write a program to convert data of one type to another using two classes.
	SET-4 Programs using Inheritance
54.	Write a program to implement concept of single inheritance using public class.
55.	Write a program to implement concept of single inheritance using private class.
56.	Write a program to implement concept of multilevel inheritance.
57.	Write a program to implement concept of multiple inheritance.
58.	Write a program to implement concept of Hybrid inheritance.
59.	Write a program to implement concept of virtual base class using inheritance.
60.	Write a program to implement concept of constructor in derived class using

	inheritance.
61.	Write a program to implement concept of initialization list in constructors using inheritance.
	SET-4 Programs using Pointers, Virtual Functions and Polymorphism
62.	Write a program to implement concept of manipulation of pointers using dereference operator.
63.	Write a program to perform arithmetic operations on pointers.
64.	Write a program to implement concept of pointers with arrays.
65.	Write a program to implement concept of array of pointer.
66.	Write a program to implement concept of pointers to function.
67.	Write a program to implement concept of pointers to objects.
68.	Write a program to implement concept of array of pointer to objects.
69.	Write a program to implement concept of 'this' pointer.
70.	Write a program to implement concept of pointers to derived objects.
71.	Write a program to implement concept of virtual functions.
72.	Write a program to implement concept of run time polymorphism using virtual function.
	SET-5 Programs using I/O Operation, Files, Template and Exceptional Handling
73.	Write a program that uses a single file for both reading and writing the data.
74.	Write a program for specifying field size using width() .
75.	Write a program for precision setting using precision().
76.	Write a program for padding with fill().
77.	Write a program to design your own manipulator to provide the following output specification for printing money value.

78.	Write a program to create a database regarding the people admit in a hospital.
79.	Write a program to swap a number using concept of function template.
80.	Write a program to create a class template to find the greater of the two numbers
81.	Write a program to perform exception handling operation.
82.	Write a program to perform exception handling for divide by zero.

Course Outcomes (COs):
By learning this course students will be able to …

1. Remember the basic programming concepts and the necessary constructs of C++ programming.
2. Understand algorithmic thinking and problem solving techniques.
3. Describe concepts like object and class, encapsulation, inheritance, polymorphism, template and exception handling for real life problems.
4. Apply advance features to make programs which supports reusability and sophistication.
5. Test standard template library for faster development.
6. Resolve C++ program using variables, operators, control structures, functions and objects.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	1	2	2	1	2	-	-	1	1	-	-	2	-	1	3
CO.2	2	3	3	2	2	1	-	2	1	-	-	2	-	1	3
CO.3	1	3	3	3	3	1	-	3	-	-	-	3	-	1	3
CO.4	1	3	3	3	3	1	-	2	-	-	-	3	-	1	3
CO.5	2	-	3	3	3	-	-	2	-	-	-	1	-	-	3
CO.6	3	3	3	3	3	1	-	3	1	-	-	2	-	-	3
Average	1.66	2.33	2.83	2.5	2.66	0.66	-	2.16	0.5	-	-	2.16	-	-	3

Delivery Methods :

Performance of Experiments using "Gnu C++ Compiler is g++" in Linux Ubuntu.

Design based Problems (DP)/Open Ended Problem :

1) Develop an object oriented application to compute the Income-tax for the salaried person.
2) Develop an object oriented system "Student Attendance Management" for recording and analyzing the student attendance.
3) Develop a library for performing various Matrix operations. Use templates to make them generalized for any data type

PC : Signals and Systems

CREDITS = 5 (L=3, T=0, P=2)

2nd Year, B. Tech. (Electronics and Communication)

Course Objective:

Students of EC Engineering need to possess good understanding of concepts and principles Of Signals & Systems by applying theorems and Transformation.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	--	--	100

Course Contents :

Unit No.	Topics	Teaching Hours	% Weightage
1	**Introduction to Signals and Systems :** Introduction ,Signals and Classification of Signals, Basic Continuous-Time Signals ,Basic Discrete-Time Signals, Systems and Classification of Systems	07	16
2	**Linear Time-Invariant Systems :** Introduction, Response of a Continuous-Time LTI System and the Convolution Integral, Properties of Continuous-Time LTI Systems, Eigen functions of Continuous-Time LTI	08	18

	Systems, Systems Described by Differential, Response of a Discrete-Time LTI System and Convolution Sum, Properties of Discrete-Time LTI Systems, Eigen functions of Discrete-Time LTI Systems, Systems Described by Difference Equations		
3	**Laplace Transform and Continuous-Time LTI Systems :** Introduction, The Laplace Transform, Laplace Transforms of Some Common Signals,Properties of the Laplace Transform ,The Inverse Laplace Transform,The System Function,The Unilateral Laplace Transform.	07	16
4	**Fourier Analysis of Continuous-Time Signals and Systems:** Introduction,Fourier Series Representation of Periodic Signals,The Fourier Transform,Properties of the Continuous-Time Fourier Transform,The Frequency Response of Continuous-Time LTI Systems ,Filtering,Bandwidth	08	17
5	**Fourier Analysis of Discrete-Time Signals and Systems :** Introduction,Discrete Fourier Series,The Fourier Transform,Properties of the Fourier Transform,The Frequency Response of Discrete-Time LTI Systems,System Response to Sampled Continuous-Time Sinusoids,The Discrete Fourier Transform	08	17
6	**State Space Analysis :** Introduction, the Concept of State, State Space Representation of Discrete-Time LTI Systems, State Space Representation of Continuous-Time LTI Systems, Solutions of State Equations for Discrete-Time LTI Systems ,Solutions of State Equations for Continuous-Time LTI Systems	07	16
	Total	45	100

Suggested specification table with marks (Theory)

Distribution of Theory Marks in %					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books :

1. Alan V. Oppenheim, Alan S.Wilsky, with S.Hamid Nawab, "Signals and Systems", Prentice-Hall of India.2nd Edition, 2010.
2. H P HSU, "Signals and systems", Schaums outlines series 2006, TATA McGraw hill. M.J.Roberts, "Signals and Systems", Tata McGraw-Hill,2006
3. Kumar, A. A. Signals and Systems, PHI Learning Pvt. Ltd.
4. Simon Haykin, "Signals and Systems ", Wiley Eastern Ltd., New Delhi.

Course Outcomes :

1. Understand the analytical frame work, mathematical description and representation of Signals and systems.
2. Derive and examine a fundamental representation of LTI systems.
3. Understand the concept of concept of continuous time LTI and the use of Laplace transform.
4. Understand the application of Fourier analysis for continuous time signals and systems.
5. Understand the application of Fourier analysis for Discrete time signals and systems.
6. Understand and analyze State Space Representation of continuous and discrete time LTI system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.1	3	2	3	1	3	2	1	1	1	1	2	3	2	2	1
PC.2	3	3	3	3	2	1	-	1	2	1	1	3	3	3	1
PC.3	3	3	3	2	3	1	1	2	2	1	1	3	3	3	1
PC.4	3	3	2	2	3	1	1	3	1	1	2	3	2	2	3
PC.5	2	2	3	3	2	1	1	1	2	2	2	3	3	3	2
PC.6	3	3	3	2	3	1	1	2	3	2	2	3	3	2	2
Average	**2.83**	**2.66**	**2.83**	**2.16**	**2.66**	**1.16**	**0.83**	**1.66**	**1.83**	**1.33**	**1.66**	**3.00**	**2.66**	**2.50**	**1.66**

Delivery Methods:

1. Lectures through Blackboard and Power-point slides.
2. Laboratory: Performance of Experiments using software MATLAB and few Practicals with hardware

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	PC.1	**Exam, Assignments, Presentation**
2.	PC.2	**Exam, Assignments, Presentation**
3.	PC.3	**Exam, Assignments, Presentation**
4.	PC.4	**Exam, Assignments, Presentation**
5.	PC.5	**Exam, Assignments, Presentation**
6.	PC.6	**Exam, Assignments, Presentation**

PC : Signals and Systems Lab

CREDITS - 1 (L=0, T=0, P=2)

2nd Year, B. Tech. (Electronics and Communication)

Course Objective :

Students of EC Engineering need to possess good understanding of concepts and principles of Signals & Systems by applying theorems and Transformation.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
0	0	2	2	0	0	40	60	100

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Details of Assessment/Instruments under CE Practical Component :

Term work [20]	Lab work [40]
Lab File	Attendance/ lab work/viva/Quiz

NOTE:

At least 10 Experiments based on available Software / Hardware.

Sr. No	Title
1.	Introduction to MATLAB.
2.	Create synthetic music using MATLAB by creating and playing a sequence of short bursts of sinusoids. Change the different parameters of the signal like sampling frequency, length of note, length of pause between notes etc and observe and hear the output signal.
3.	Write MATLAB code to plot the CT and DT signals.
4.	Write MATLAB code to plot the signal with user define function 'ramp' and 'ustep'. Also find the even and odd part of the signal.
5.	Write MATLAB code to plot the Convolution of DT & CT signals with & without 'conv' function and plot the graph of signals & its convolution in same window with proper label and title.
6.	Write MATLAB code to Express the signals as sum of singular functions with proper label and title. Use 'ramp' and 'ustep' as a function to generate appropriate output.
7.	Write MATLAB code to understand the concept of Fourier transform to find the frequency components of a signal buried in a noisy time domain signal. Consider data sampled at 1000 Hz. Form a signal containing a 50 Hz sinusoid of amplitude 10 and 120 Hz sinusoid of amplitude 15 and corrupt it with some zero-mean random noise:
8.	Write MATLAB code to understand the concept Aliasing.
9.	Write a MATLAB program to understand the concept of Laplace transform.
10.	Write a MATLAB program to understand the concept of Fourier Series.
11.	Write a MATLAB program to understand State space representation of DT and CT LTI Systems and its application.

Suggested specification table with marks (Theory)

Distribution of Theory Marks %					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers.The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Alan V. Oppenheim, Alan S.Wilsky, with S.Hamid Nawab, "Signals and Systems", Prentice-Hall of India.2nd Edition, 2010.
2. H P HSU, "Signals and systems", Schaums outlines series 2006, TATA McGraw hill.
3. M.J.Roberts, "Signals and Systems", Tata McGraw-Hill,2006
4. Kumar, A. A. Signals and Systems, PHI Learning Pvt. Ltd.
5. Simon Haykin, "Signals and Systems ", Wiley Eastern Ltd., New Delhi.

Course Outcomes :

1. Understand the analytical frame work, mathematical description and representation of Signals and systems.
2. Derive and examine a fundamental representation of LTI systems.
3. Understand the concept of concept of continuous time LTI and the use of Laplace transform.
4. Understand the application of Fourier analysis for continuous time signals and systems.
5. Understand the application of Fourier analysis for Discrete time signals and systems.
6. Understand and analyze State Space Representation of continuous and discrete time LTI system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.1	3	2	3	1	3	2	1	1	1	1	2	3	2	2	1
PC.2	3	3	3	3	2	1	-	1	2	1	1	3	3	3	1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.3	3	3	3	2	3	1	1	2	2	1	1	3	3	3	1
PC.4	3	3	2	2	3	1	1	3	1	1	2	3	2	2	3
PC.5	2	2	3	3	2	1	1	1	2	2	2	3	3	3	2
PC.6	3	3	3	2	3	1	1	2	3	2	2	3	3	2	2
Average	**2.83**	**2.66**	**2.83**	**2.16**	**2.66**	**1.16**	**0.83**	**1.66**	**1.83**	**1.33**	**1.66**	**3.00**	**2.66**	**2.50**	**1.66**

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	PC.1	**Exam, Assignments, Presentation**
2.	PC.2	**Exam, Assignments, Presentation**
3.	PC.3	**Exam, Assignments, Presentation**
4.	PC.4	**Exam, Assignments, Presentation**
5.	PC.5	**Exam, Assignments, Presentation**
6.	PC.6	**Exam, Assignments, Presentation**

Active Learning Assignments : (Mini Project)

Preparation of Mini Project based on the subject theory & Practicals and presentation through power-point slides/paper with hardware/software, which include algorithms, videos, animations, pictures, and graphics. The faculty may allocate chapters/ parts of chapters to groups of students for presentation.

CONTROL SYSTEMS

CREDITS - 5 (L=3, T=*0*, P=*2*)

2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective : To explore the fundamentals of systems and control.To focus on (1) Understanding and predicting system behavior (2) Design and analysis of closed loop control systems and (3) System stability prediction.

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Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				T		P		L
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Practical Component:

Internal Exam **[30 Mark]**	Continuous assessment **[10 Mark]**
Mid Sem 1 Exam , Mid Sem 2 Exam, Remedial Exam	Assignments/ Presentations/ Quiz etc based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

Course Contents :

Unit No.	Topics	Teaching Hours	Module Weightage
1.	**Introduction to Control Systems:** Introduction, Examples of Control Systems, Closed-loop Control versus Open-Loop Control, Design and Compensation of Control Systems.	05	10 %

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Unit No.	Topics	Teaching Hours	Module Weightage
2.	**Mathematical Modeling of Control Systems:** Introduction, Transfer Function and Impulse-Response Function, Mathematical Modelling of Mechanical Systems, Mathematical Modelling of Electrical Systems, Block Diagram Reductions and Signal Flow Graphs, Design Examples.	08	18 %
3.	**State Variable Models:** Introduction, The State Variable of a Dynamic System, The State Differential Equation, Signal Flow Graph and Block Diagram Models using State Space, Alternative Signal Flow Graph and Block Diagram Models, The Transfer Function from the State Equation, Design Examples.	08	18 %
4.	**Transient and Steady State Response Analysis:** Introduction, Test Input Signals, First-Order Systems, Second-Order Systems, Performance Indices, The s-plane Root Location and Transient Response, Control Actions and its Effect on System Performance, Steady-State Errors in Unity-Feedback Control Systems, Design Examples.	08	18 %
5.	**Control System Analysis and Design by Root Locus Analysis:** Introduction, The Concept of Stability, The Routh-Hurwitz Stability Criterion, The Relative Stability of Feedback Control System, Root-Locus Plots, General Rules for Constructing Root Loci, Lead Compensation, Lag Compensation, Lag-Lead Compensation, Effect of Additions of Open-loop Poles and Zeroes on Root Locus, Design Examples.	08	18 %
6.	**Control System Analysis and Design by Frequency Response Method:** Introduction, Frequency Response Plots and Measurements, Bode Diagrams, Polar Plots, Log-Magnitude-versus-Phase Plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability Analysis, Lead Compensation, Lag Compensation, Lag-Lead Compensation, Design Examples.	08	18 %
Total Hours		45	100 %

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
10	14	14	16	06	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers.The actual distribution of marks in the question paper may vary slightly from above table.

List of References :

1. Richard C. Drof and Robert H. Bishop, "*Modern Control System*", Pearson Education, 11th Edition, 2008.
2. Katsuhiko Ogata, "*Modern Control Engineering*",Prentice Hall of India, 5thEdition,2010.
3. Benjamin C.Kuo & Farid Golnaraghi, "*Automatic Control Systems*", John Wiley & Sons, 8thEdition, 2002.
4. Nagrath and Gopal, "*Control Systems Engineering*", New Age Publication, 5thEdition, 2007.

CO Course Outcomes (COs):
By learning this course student will be able to …

1. Demonstrate an understanding of the fundamentals of feedback control systems.
2. Understand systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
3. Predict system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
4. Analyze the absolute stability of a closed-loop control system.
5. Apply Root-Locus, Bode-Plot and Niquist-Plot techniques to analyze and design control systems.

6. Design controllers using classical PID methods.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	3	1	3	2	1	1	1	1	2	3	2	2	1
CO.2	3	3	3	3	2	1	-	1	2	1	1	3	3	3	1
CO.3	3	3	3	2	3	1	1	2	2	1	1	3	3	3	1
CO.4	3	3	2	2	3	1	1	3	1	1	2	3	2	2	3
CO.5	2	2	3	3	2	1	1	1	2	2	2	3	3	3	2
CO.6	3	3	3	2	3	1	1	2	3	2	2	3	3	2	2
Average	**2.83**	**2.66**	**2.83**	**2.16**	**2.66**	**1.16**	**0.83**	**1.66**	**1.83**	**1.33**	**1.66**	**3.00**	**2.66**	**2.50**	**1.66**

Delivery Methods:

Lectures through Blackboard and Power-point slides

CONTROL SYSTEM LAB

CREDITS - 1 (L=0, T=0, P=2)

2nd Year, B. Tech. (*Electronics and Communication*)

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		L
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 mark):

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of The following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance .

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File	Attendance	Quiz	OEP	Experimental Skills	Total
10	10	10	20	10	60

List of Experiments:

(a) Experiments using Trainer Kits

Sr. No.	Name of Experiment
1.	To study about open loop control system: OP-AMP as comparator.
2.	To study about closed loop control system: OP-AMP as inverting amplifier
3.	To study about Type-0 control system and also find steady state error.
4.	To study about Type-1 control system and also find steady state error.
5.	To study about Type-2 control system and also find steady state error.
6.	To study about P control system.
7.	To study about PI control system.
8.	To study about PD control system.
9.	To study about PID control system.

(b) Experiments using Matlab Simulation :

Sr. No.	Name of Experiment
1.	To study about open loop control system in simulink using Matlab.
2.	To study about closed loop control system in simulink using Matlab.
3.	To determine pole-zero configuration of transfer function of system and implementation of block diagram reduction of system in Matlab.

4.	To find out steady state error of Type-0, Type-1 and Type-2 control system in Matlab.
5.	To obtain correlation between transfer function and state space of mechanical system using Matlab.
6.	To simplify the complex block diagram in simulink using Matlab.
7.	To find the impulse and step response of first order system using Matlab.
8.	To find step response of second order system using Matlab.
9.	To study about P control system and implement the same in simulink using Matlab.
10.	To study about PI control system in simulink using Matlab.
11.	To study about PD control system in simulink using Matlab.
12.	To study about PID control system in simulink using Matlab.
13.	To find root locus, bode-plot and Niquist-plot of system using Matlab.

Course Outcomes (COs):

By learning this course student will be able to …

1. Demonstrate an understanding of the fundamentals of feedback control systems.
2. Understand systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
3. Predict system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
4. Analyze the absolute stability of a closed-loop control system.
5. Apply Root-Locus, Bode-Plot and Niquist-Plot techniques to analyze and design control systems.
6. Design controllers using classical PID methods.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	3	1	3	2	1	1	1	1	2	3	2	2	1

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.2	3	3	3	3	2	1	-	1	2	1	1	3	3	3	1
CO.3	3	3	3	2	3	1	1	2	2	1	1	3	3	3	1
CO.4	3	3	2	2	3	1	1	3	1	1	2	3	2	2	3
CO.5	2	2	3	3	2	1	1	1	2	2	2	3	3	3	2
CO.6	3	3	3	2	3	1	1	2	3	2	2	3	3	2	2
Average	**2.83**	**2.66**	**2.83**	**2.16**	**2.66**	**1.16**	**0.83**	**1.66**	**1.83**	**1.33**	**1.66**	**3.00**	**2.66**	**2.50**	**1.66**

Delivery Methods :

Laboratory : Performance of Experiments using Control System trainer kits, Oscilloscope,
Function Generator, Digital Millimeter and software Matlab.

Design based Problems (DP)/Open Ended Problem:

1) OP Amp Differentiating Circuit, Pulse Generating Op Amp, OP Amp Control System and PLL
2) Television Beam Circuit
3) Space Shuttle Rocket, Satellite Orientation Control and Roll Angle Control
4) Mars Rover Vehicle and Mars Guided Vehicle Control
5) Disk Drive Read Write System and Rotating Disk Speed Control

Analog Communication

CREDITS - 3 (L= 3,T=0,P=0)

2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

Understanding electronic communications systems in analog form from deterministic approach.Design and Analysis of analog communications systems.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	100

3	0	0	3	60	40	-	-	

Details of Assessment Instruments under CE Theory Component:

Internal Exam **[30 Mark]**	Continuous assessment **[10 Mark]**
Mid-Sem Exam, Remedial Exam	Assignments, Presentations, Quiz.

Course Contents :

Unit No.	Topics	Teaching Hours	% Weightage
1	**Introduction to communication systems :** Understand the Communication system, Analog and digital Messages, Channel effect, Modulation and detection, Bandwidth of different information signals, Historical review of telecommunication, Applications, Review of signal and systems.	4	10
2	**Analog Signal Transmission :** A periodic signal representation by Fourier integral, Transform of some useful function, Some properties of the Fourier transform, Signal transmission through a linear system, Ideal and practical filters, Signal distortion over a communication channel, Signal energy and energy spectral density, Signal power and power spectral density.	6	10
3	**Noise :** Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise.	8	20
4	**Amplitude Modulations and demodulations :** Concept of modulation, Mathematical representation of	12	25

	sinusoidal Amplitude modulated signals in time and frequency domain- Double sideband Full carrier (DSBFC) , Double sideband suppressed carrier(DSBSC) and single sideband suppressed carrier modulations(SSBSC), Vestigial Sideband (VSB) modulation and Quadrature amplitude modulation(QAM), power and bandwidth calculations for DSBFC, DSBSC, SSBSC, VSB and QAM modulations, Non sinusoidal AM – effective modulation index, Effective voltage and current for sinusoidal and non-sinusoidal AM, AM generation: FET balanced modulator and IC balanced modulator circuits, Diode ring modulator, SSB generation: balanced modulator-filter method, phasing method and the third method, AM detection: peak (envelope detector), synchronous detectors, square law detectors, Functions of radio receivers, working of super heterodyne radio receivers, AM receivers.		
5	**Angle Modulations and demodulations:** Concept of instantaneous frequency and angle modulation, sinusoidal FM and its time domain representation, spectral components of angle modulated signals, power in sinusoidal FM and modulation index, Carson's rule, equivalence between Frequency modulation(FM) and Phase modulation(PM), Angle modulator circuits, FM transmitters, Armstrong method of FM generation, Fm stereo broadcast, FM detection: Basic slope detector, Foster-Seeley discriminator, ratio detector, PLL detector and Quadrature detector, Concept of Amplitude limiter, Pre-emphasis and de-emphasis circuits, Interference in angle modulated system, sensitivity and gain, image rejection, spurious responses, Adjacent channel selectivity, Automatic gain control, FM receivers..	11	25
6	**Pulse Modulation:** Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation and demodulation of PWM, PPM, Generation and demodulation of PPM.	4	10
	Total	45	100

Suggested specification table with marks (Theory) :

Distribution of Theory Marks in %					
R Level	U Level	A Level	N Level	E Level	C Level
25	30	20	25	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E:

Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers.The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books :

1.B.P.Lathi, Zhi Ding, "*Modern Analog and Digital communication system*", 4th Edition, Oxford University press, 2010.
2. Simon Haykins,"*Communication Systems*",John Wiley & Sons, 4th Edition.
3. Dennis Roddy, John Coolen, "*Electronic Communication*", Fourth Edition, Prentice Hall,2005.
4. John G. Prokis, Masoud Salehi, "*Fundamentals of Communication Systems*", Third Impression Pearson Education India, 2008.
5. George Kennedy, Bernard Davis, S.R.M. Prasanna, "*Electronic Communication Systems*", Tata McGraw Hill Education Limited, 5th Edition, 2011.
6. Sanjay Sharma, "Analog Communication Systems", Second Edition, S K Kataria & Sons, 2007.
7. Frenzel Louis,"*Communication Electronics - Principles and Applications*",Tata McGraw-Hill Education,3rd Edition,1994.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand the basics of communication system.
2. Evaluate the Fourier transform to analyse various signals and observe their frequency domain contents.
3. Explain different types of noise related to communication systems.
4. Demonstrate Amplitude modulation and demodulation techniques.
5. Implement Angle modulation and demodulation techniques.
6. Classify various types of pulse modulation techniques.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.1	3	2	2	1	1	1	-	-	1	3	2	3	3	1	2
PC.2	3	2	2	2	1	2	-	--	2	2	2	3	3	2	2
PC.3	3	2	1	1	1	2	-	-	2	2	1	3	3	1	2

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
PC.4	3	3	2	1	2	3	-	-	2	2	1	3	3	2	2
PC.5	3	2	2	1	1	3	-	-	2	2	2	3	3	2	2
PC.6	3	2	2	1	2	3	-	-	3	3	2	3	3	2	2
Average	3	2.16	1.83	1.16	1.33	2.33	-	-	2.0	2.33	1.66	3	3	1.66	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	PC.1	**Exam,Assignments, Presentation**
2.	PC.2	**Exam,Assignments, Presentation**
3.	PC.3	**Exam,Assignments, Presentation**
4.	PC.4	**Exam,Assignments, Presentation**
5.	PC.5	**Exam,Assignments, Presentation**
6.	PC.6	**Exam, Assignments, Presentation**

Active Learning Assignments :

Preparation of power-point slides, which include videos, animations, pictures, and graphics For better understanding practical work – The faculty will allocate chapters/ parts of chapters to groups of students.

PC: Analog Communication Lab

CREDITS - 2 (L=L_0, T=T_0, P=P_2)

2^{th} Year, B. Tech. (Electronics & Communication)

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An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

Course Objective: To provide practical knowledge about various electronics and communication circuits.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	2	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component :

Term work [20]	**Lab work [40]**
Lab File	Attendance, lab work, viva, Quiz.

NOTE:

At least 10 Experiments based on available Trainer Kits/ Software. Also performed on Bread-Board using Active/Passive Components.

Sr. No.	**LIST OF EXPERIMENTS:**
1	To generate amplitude modulation (AM) waveform and to measure modulation index of AM wave using waveform method and trapezoidal method.
2	To extract information signal from the AM wave using Diode Detector.
3	To simulate Amplitude Modulation Using Simulink.
4	To observe frequency modulated waveform and to measure peak frequency deviation for 2V peak to peak modulating signal.
5	To extract information signal from the FM wave using FM detector.
6	To Simulate Frequency Modulation using MATLAB-code.
7	To obtain frequency response of pre-emphasis And de-emphasis circuits.

Sr. No.	LIST OF EXPERIMENTS:
8	To generate SSB signal using balance modulator and single sideband filter.
9	To understand working of AGC circuit. To measure output of amplifier circuit with and without AGC circuit.
10	To understand block diagram of super-heterodyne AM and FM receiver.
11	To obtain frequency response of RF amplifier.
12	To obtain fidelity of the AM and FM receiver.

Reference Books:

1. B.P.Lathi, Zhi Ding, "Modern Analog and Digital communication system", 4th Edition, Oxford University press, 2010.
2. Simon Haykins,"Communication Systems", John Wiley & Sons, 4th Edition.
3. Dennis Roddy, John Coolen, "Electronic Communication", Fourth Edition, Prentice-Hall,2005.
4. John G. Prokis, Masoud Salehi, "Fundamentals of Communication Systems", Third Impression Pearson Education India, 2008.
5. George Kennedy, Bernard Davis, S.R.M. Prasanna, Electronic Communication Systems, Tata McGraw Hill Education Limited, 5th Edition, 2011.
6. Sanjay Sharma, "Analog Communication Systems", Second Edition, S K Kataria & Sons, 2007.
7. Frenzel Louis," Communication Electronics - Principles and Applications", Tata McGraw-Hill Education, 3rd Edition, 1994.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand the basics of communication system.
2. Evaluate the Fourier transform to analyse various signals and observe their frequency domain contents.
3. Explain different types of noise related to communication systems.
4. Demonstrate Amplitude modulation and demodulation techniques.
5. Implement Angle modulation and demodulation techniques.
6. Classify various types of pulse modulation techniques.

Course Articulation Matrix :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1 3	PSO1 4	PSO1 5
PC.1	3	2	2	1	1	1	-	-	1	3	2	3	3	1	2
PC.2	3	2	2	2	1	2	-	--	2	2	2	3	3	2	2
PC.3	3	2	1	1	1	2	-	-	2	2	1	3	3	1	2
PC.4	3	3	2	1	2	3	-	-	2	2	1	3	3	2	2
PC.5	3	2	2	1	1	3	-	-	2	2	2	3	3	2	2
PC.6	3	2	2	1	2	3	-	-	3	3	2	3	3	2	2
Average	3	2.16	1.83	1.16	1.33	2.33	-	-	2.0	2.33	1.66	3	3	1.66	2

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	PC.1	**Experiments, Exam, Assignments , Presentation**
2.	PC.2	**Experiments , Exam, Assignments , Presentation**
3.	PC.3	**Experiments , Exam, Assignments , Presentation**
4.	PC.4	**Experiments , Exam, Assignments, Presentation**
5.	PC.5	**Experiments , Exam, Assignments, Presentation**
6.	PC.6	**Experiments , Exam, Assignments, Presentation**

Design based Problems (DP)/Open Ended Problem:

1. Design an AM transmitter for a frequency of 1 MHz.
2. Design an AM receiver for a frequency of 1 MHz.
3. Design an FM transmitter for a frequency of 50 MHz.
4. Design an FM receiver for a frequency of 50 MHz.

Course Code: Microprocessor and Computer architecture
Program core Course
CREDITS - 3 (L=L_3, T=T_0,P=P_0)

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Gujarat, India

2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To acquaint the students with the programming, interfacing, applications of microprocessors and computer architecture.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40			100

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Introduction To 8-bit Microprocessor :** History of Microprocessor, 8085 Microprocessor architecture, buses, register, flags. 8085 pin configuration & function of each pin. Fetch, Decode and execute operations. Op-code Fetch, execute cycle, T state, Machine cycle. Memory and I/O read and write cycles WAIT state, interrupt timing diagram.	10	20
2.	**8085 Microprocessor Instruction Set and Programming :** Addressing modes of 8085. Data transfer, Arithmetic, Logical, Rotate, Branch and machine control instructions. Development of 8085 assembly language programs, time delays. Concept of stack and Instruction related to stack. 8085 interrupts, RST, RIM, SIM instructions. Subroutines and conditional call instruction.	12	25
3.	**Interfacing of Memory Chips & Input / Output Chips :** Memory mapped I/O and I/O mapped I/O. Address decoding, interfacing of memory chips with 8085. Interfacing of input/output devices and special purpose peripheral IC 8255(PPI), 8253(Timer), 8259(PIC), 8237(DMAC) with 8085.	12	25

4.	**Computer Architecture Control Unit :** Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit.	**6**	**18**
5.	**Memory organization :** Classification and Introduction, RAM, ROM, Memory management, Concept of Cache& associative memories, Virtual memory.	**5**	**12**
	Total Hours and Weightage	**45**	**100%**

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	30	25	20		

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References:

1. Microprocessor Architecture, Programming, and Applications with the 8085 –Ramesh S. Gaonkar Pub: Penram International.
2. 8085 Microprocessor: Programming And Interfacing – By N.K.Srihnath, PHI
3. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization", VI edition, McGraw-Hill Inc, 2012.
4. William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.
5. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.

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Gujarat, India

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand the concepts of microprocessors architecture their principles and practices.
2. Write efficient programs in assembly language of the 8085 family of microprocessors.
3. Interface microprocessor with memory modules and I/O modules.
4. Apply the concept of the logic design for developing Control unit.
5. Demonstrate architectural design of modern processors, memories and I/Os.

1. Course Articulation Matrix:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 13	PSO 14	PSO 15
Code.1	3	2	2	2	1	2	-	-	1	-	-	2	3	3	3
Code.2	3	2	3	3	3	2	-	--	3	-	-	3	3	3	3
Code.3	3	2	3	2	1	2	-	-	2	-	-	2	3	3	3
Code.4	3	2	3	3	3	2	-	-	3	-	-	3	3	3	3
Code.5	3	2	2	2	1	2	-	-	1	-	-	2	3	3	3
Average	3	2	2.6	2	1.8	2	-	-	2			2.4	3	3	3

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures etc.
2. Laboratory: Design and implementation of digital circuits using trainer kits, bread board, digital ICs etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	Code.1	**Exam, Assignments, Presentation, Experiments**
2.	Code.2	**Exam, Assignments, Presentation, Experiments**
3.	Code.3	**Exam, Assignments, Presentation, Experiments**

4.	Code.1	**Exam, Assignments, Presentation, Experiments**
5.	Code.2	**Exam, Assignments, Presentation, Experiments**

PC: Microprocessor and Interfacing Lab

CREDITS - 2 (L=0, T=0, P=2)

2nd Year, B. Tech. (Electronics & Communication)

Course Objective: *To provide the basic knowledge of programming in assembly language, particularly with 8-bit processor, interfacing with 8-bit peripherals.*

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	-	-	40	60	100

Continuous Evaluation: 60 Marks based on two major components :

Term work [30]	Assessment Tools [30]
Practical File/Attendance/ lab work	Open ended problem/ Quiz/presentation of ALA/ Assignment

Experiment List :

1. **Introduction to Microprocessor and Trainer Kit.**
   - Write an assembly level program to add Two 8-bit hex and BCD numbers.
   - Write an assembly level program to subtract one 8-bit number from the other.

2. **Programs based on Data Transfer, Arithmetic and logical instructions.**
   - Write an assembly level program to add Two 16-bit hex number and 4-digit BCD numbers.
   - Write an assembly level program to Ex-or the two 8-bit numbers without using logical

instruction (XOR).

3. **Programs based on Arithmetic, logical and Branching instructions.**
   - Write an assembly level program to add an array of Hex numbers and BCD numbers.
   - Write an assembly level program to separate the hex numbers, which are greater than 20H and Less than 50H, from the given array.

4. **Programs based on Sorting of an Array.**
   - Write an assembly level program to find the maximum and minimum numbers from the given array.
   - Write an assembly level program to sort a given array in ascending and descending order.

5. **Programs based on Array Manipulation.**
   - Write an assembly level program to add corresponding elements of two arrays and store the result in third array.
   - Write an assembly level program to insert a particular number in an sorted array to the proper position.

6. **Programs to Generate specific Time Delay.**
   - Write a subroutine to generate a delay of specific amount of time.
   - Write an assembly level program to generate digital clock using the display fields of the trainer kit.

7. **Programs based on data conversion.**
   - Write an assembly level program to convert given hex data in to equivalent BCD and given BCD in to equivalent Hex.

8. **Programs based on Interrupts.**
   - Write an assembly level program to count the number of times the interrupt is generated by the user and display the count on the data field of the display unit of the trainer kit.

9. **Programs based on multiplication and division of numbers.**
   - Write an assembly level program to multiply two 8 bit numbers using ADD-SHIFT method.
   - Write an assembly level program to divide an 8-bit number from the given 8-bit number using ADD-SHIFT method.

10. **Interfacing with 8085 microprocessor.**
    - Interfacing with 8255.
    - Interfacing of ADC with 8085.
    - Interfacing of DAC with 8085.

Open Ended problem:

6) Designing 4-bit ALU
7) Design and Develop traffic controller based on 8-bit controller/processor
8) Interface stepper motor with 8085 microprocessor using 8255, rotate it counterclockwise.
9) Design a digital system to monitor room temperature using ADC connected with 8255.
10) Design a digital clock using 6 seven-segment displays (common cathode) using 8255 PPI and 8253 PIT (to generate time delay).

Major Equipments:

1. 8085 microprocessor trainer kit with peripheral devices.
2. Computer Systems.
3. CRO, Power Supply

Open Source Software/Websites:

1. 8085 Simulator.
2. nptel.ac.in
3. MOOC courses.

PC : Electronic Measurements and Instrumentation
CREDITS = 3 (L=3, T=0, P=0)
2nd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

The students will be familiar with the basics of Electronics measurements and Instruments. The fundamentals of signal conditioning circuits for the use of the various sensors are also to be understood.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Practical Component :

Internal Exam	Continuous Assessment

[30]	[10]
Mid Sem 1, Mid Sem 2, Remedial Exam	Assignments, Quiz, Presentations, Attendance

Course Contents :

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Introduction :** Definitions, Accuracy and Precision, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors,	05	15
2	**Measurements and Instrumentations :** Analog Data Representation, Definitions, Sensor Time Response: first order, second order, Analog and Digital Processing.	05	15
3.	**Analog Signal Conditioning :** Introduction, Principles of Analog Signal Conditioning, Passive Circuits, Op Amp Circuits in Instrumentation, Active Filter design using Op-Amp.	10	20
4.	**Digital Signal Conditioning :** Review of Digital Fundamentals, Converters, Data-Acquisition Systems, Characteristics of Digital Data.	08	20
5.	**Transducers and Sensors :** Definition of Temperature. Metal Resistance versus Temperature Devices, Thermistors, Thermocouples, Other Thermal Sensors, Displacement, and location or position sensor: Potentiometric sensor, capacitive & Inductive sensor, level sensor; Strain Sensor: metal strain gauges, semiconductor strain gauges, load cells. Fundamentals of EM Radiation, Photo detectors, Optical Sources,.	12	20
6	**Isolation Techniques :** Transformer Isolation, Optical Isolation, Digital Techniques, For Optical Isolation.	05	10

Unit No.	Topics	Teaching Hours	% Weightage
	Total Hours	45	100

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	20	15	10	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate
C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The
actual distribution of marks in the question paper may vary slightly from above table.

List of References :

1. Johnson, Curtis D. "*Process control instrumentation technology*". Prentice Hall PTR, 1999.
2. Ramakant Gayakwad. "*Op-amps and linear integrated circuits*". Prentice-Hall, Inc., 1993.
3. Kalsi H. S. "*Electronic Instrumentation*", Tata McGraw-Hill Education, 2nd Ed., 2004.
4. Rangan C. S., Sarma G. R. and Mani V. S. V., "*Instrumentation devices and systems*", Tata McGraw-Hill, 2nd Ed., 2004.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Recollect the basic knowledge of measurement units, standards and definitions.
2. Study and Measure the characteristics of the various control systems and sensor responses.
3. Understand & Analyze important of analog signal conditioning using Op-amp.
4. Understand & analyze important of Digital signal conditioning and data acquisition systems.
5. Categorize the different sensors and transducers its characteristics.
6. Study and measure parameters of various Isolation techniques. .

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Course Articulation Matrix :

Note: Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:
1: Slight (Low) *2: Moderate (Medium)* *3: Substantial (High)* *'-': Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
CO.1	3	2	1	1	1	1	--	--	1	--	1	3	1	1	1
CO.2	3	2	1	1	2	2	--	--	2	--	1	3	2	1	1
CO.3	3	3	2	1	2	1	--	--	2	--	2	3	3	3	1
CO.4	3	3	2	2	2	1	--	--	2	--	2	3	3	3	2
CO.5	3	3	2	2	2	2	--	--	2	--	2	3	2	1	3
CO.6	3	2	1	1	1	2	--	--	2	--	2	3	2	1	2
Avg:	3	2.5	1.5	1.3	1.6	1.5	--	--	1.8	--	1.6	3	2.1	1.6	1.6

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.

2. Laboratory: Performance of Experiments Using Trainer kits, Bread board, Sensors,

Transducers, Active & Passive Components, ICs, Function Generator, Oscilloscopes, Digital

Multimeter and Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assesment tools
1.	CO.1	**Exam,Assignments,Presentation,Experiments etc**
2.	CO.2	**Exam,Assignments, Presentation,Experiments etc**
3.	CO.3	**Exam,Assignments, Presentation,Experiments etc**
4.	CO.4	**Exam,Assignments, Presentation,Experiments etc**
5.	CO.5	**Exam,Assignment,Presentation,Experiments etc**
6.	CO.6	**Exam,Assignments, Presentation,Experiments etc**

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PC: Electronic Measurements and Instrumentation Lab
CREDITS = 1(L = 0, T = 0, P =2)

➢ **For Lab Course :**

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

- 60-mark distribution. (Internal Continuous Evaluation)

File	Record Book	Oral Test	Quiz	Attendance	Project	Total
10	10	10	10	10	10	60

Practicals List :

At Least 10 Experiments based on available Trainer kits :

1. To find the value of unknown resistor using Wheatstone bridge.
2. To find the value of unknown capacitance and inductance using Maxwell's bridge.
3. To find the value of unknown capacitance using Wein's series and parallel bridge.
4. To study and design Instrumentation amplifier using Op-amp.
5. To study and design active filters using Op-amp.
6. To extend the range of given voltmeter and ammeter.
7. Measurement of frequency using Lissajous method.
8. To study and verify characteristic of variable resistor transducer (strain gauge).

9. To study and verify characteristic of LVDT
10. To study and verify characteristic of Thermocouple/RTD.
11. To study the front panel controls of storage CRO
12. To analyze analog and digital multi meter for various measurements
13. To demonstrate the functionality of function generator and its use as a test and measurement equipment.
14. Measurement of LCRQ meter.
15. Fourier series analysis of a square wave using spectrum analyzer.

AGENDA ITEM 3 : EC1819.2.3

AGENDA	DESCRIPTION
EC1819.2.3	To Discuss, Suggest and Approve amendment in Teaching Structure of Third and Fourth Level of UG Programme. as per Annexure - III

Annexture-III

Amendment Teaching Structure (Proposed and Approve) for **Third Level** of UG Programme under BVM (Autonomous).

Sr. No	Course Category Code	Name of Course	L	T	P	H	C
		Semester - V					
1.	HS	Engineering Economics and Management (Title will finalized at Institute level)	3	0	0	3	3
2.	PC	Electromagnetics Theory	3	0	0	3	3
3.	PC	Microcontroller and Applications	3	0	0	3	3
4.	PC	Microcontroller and Applications Lab	0	0	2	2	1
5.	PC	CMOS Digital Integrated Circuits	3	0	0	3	3
6.	PC	CMOS Digital Integrated Circuits Lab	0	0	2	2	1

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		Programme Elective – I					
7.	PE	Power Electronics	3	0	0	3	3
8.	PE	Power Electronics Lab	0	0	2	2	1
9.	PE	Digital Design Using HDL	3	0	0	3	3
10.	PE	Digital Design Using HDL Lab	0	0	2	2	1
11.	PE	Industrial Automation	3	0	0	3	3
12.	PE	Industrial Automation Lab	0	0	2	2	1
		Open Elective – I	3	0	2	5	4
13.	OE	Introduction to Cellular Communication					
14.	OE	Applied Electronics					
		Total	18	0	8	26	22
		Semester – VI	**L**	**T**	**P**	**H**	**C**
1.	PC	Digital Communication	3	0	0	3	3
2.	PC	Digital Communication Lab	0	0	2	2	1
3.	PC	Antennas and Wave Propogation	3	0	0	3	3
4.	PC	Antennas and Wave Propogation Lab	0	0	2	2	1
5.	PC	Advance Microcontroller	2	0	0	2	2
6.	PC	Advance Microcontroller Lab	0	0	2	2	1
7.	PC	Digital Signal Processing	3	0	0	3	3
8.	PC	Digital Signal Processing Lab	0	0	2	2	1
		Programme Elective – II	3	0	0	3	3
9.	PE	Introduction to Real Time Operating System					
10.	PE	Optical Fiber Communication					
11.	PE	Satelite Communication					
		Open Elective – II	3	0	0	3	3
12.	OE	Embedded Systems and IOT					

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		Total	17	0	8	25	22

Amendment in Teaching Structure (Proposed and Approved) for **Final Level** of UG Programme Under BVM (Autonomous).

Sr. No	Course Category Code	Name of Course	L	T	P	H	C
		Semester - VII					
1.	PC	Computer Networks	3	0	0	3	3
2.	PC	Computer Networks Lab	0	0	2	2	1
3.	PC	Wireless Communication	3	0	0	3	3
4.	PC	Wireless Communication Lab	0	0	2	2	1
5.	PC	Embeded System Design with IOT	3	0	0	3	3
6.	PC	Embeded System Design with IOT Lab	0	0	2	2	1
7.	PW/PROJ*	Guided Research	0	0	4	4	2
8.	PC	Electronic Product Design	0	0	2	2	1
		Programme Elective – III					
8.	PE	Digital Image Processing	3	0	0	3	3
9.	PE	Digital Image Processing Lab	0	0	2	2	1
10.	PE	Bio Medical Instrumentation	3	0	0	3	3
11.	PE	Bio Medical Instrumentation Lab	0	0	2	2	1
12.	PE	RF and Microwave Engineering	3	0	0	3	3

13.	PE	RF and Microwave Engineering Lab	0	0	2	2	1
		Total	12	0	14	26	19
		Semester – VIII	**L**	**T**	**P**	**H**	**C**
		Programme Elective – IV					
1.	PE	Radar & Navigational Aids	3	0	0	3	3
2.	PE	Radar & Navigational Aids Lab	0	0	2	2	1
3.	PE	Machine Learning	3	0	0	3	3
4.	PE	Machine Learning Lab	0	0	2	2	1
5.	PE	Advance Communication Systems	3	0	0	3	3
6.	PE	Advance Communication Systems Lab	0	0	2	2	1
		Programme Elective – V	1	0	2	3	2
7.	PE	Virtual Instrumentation					
8.	PE	Device Driver Development					
9.	PE	Android Programming					
10.	PW	Project	0	0	18	18	9
		Total	4	0	22	26	15
OR							
		Semester – VIII	**L**	**T**	**P**	**H**	**C**
1.	PW/PROJ*	Industry Project	0	0	30	30	15

Proposed Semester wise distribution of courses under different categories is shown in Below table .It is suggested that it is proposed by CDB that no theory component for any course should exceed 3 hours per week . All board of studies are requested to prepare the structure of Studies for Minimum 154 credits and Maximum 160 credits.

SEM	HS	BS	ES	PC	PE	OE	PW	MC	CREDITS	HRS
1	4	9	5	-	-	-	-	4 Hr	18	27
2	0	5	15	-	-	-	-	-	20	25
3	2	7	1	12	-	-	-	-	22	26
4	0	-	4	16	-	-	1	-	21	27
5	3	-	-	11	4	4	-	-	22	26
6	-	-	-	16	3	3	-	-	22	25

7	-	-	-	13	4	-	2	-	19	26
8	-	-	-	-	6	-	9	-	15	26
Total	**09**	**21**	**25**	**68**	**17**	7	**12**	**4 Hr**	**159**	**208**

HS = Humanities and Science ,BS = Basic Science ,ES = Engineering Science ,PC = Professional Core Courses , OE = Open Electives ,PW/PROJ* = Project Work ,Seminar And Intership , MC = Mandatory Non Credit Course

AGENDA ITEM - 4

AGENDA	DESCRIPTION
1.	Various NPTEL Courses offered as alternate of Available programme electives or as additional Electives for UG Programme under BVM Autonomous Scheme.

NPTEL COURSES AS ALTERNATE FOR PROGRAMME ELECTIVES FOR B.TECH (EC) Program under BVM Autonomous Scheme. w.e.f A.Y-2018-19 Even Semester.

Sr. No	Course Ids	Course Name	Duration	Course Start Date	Course End Date	Exam date
1	noc19-cs04	Computer Organization and Architecture: A Pedagogical Aspect	12 Weeks	28 January 2019	19 April 2019	28 April 2019
2	noc19-cs07	Programming in Java	12 Weeks	28 January 2019	19 April 2019	28 April 2019
3	noc19-cs12	Data Base Management System	8 Weeks	25 February 2019	19 April 2019	27 April 2019
4	noc19-cs24	Hardware Security	12 Weeks	28 January 2019	19 April 2019	28 April 2019
5	noc19-cs26	Block chain Architecture and Use Cases	12 Weeks	28 January 2019	19 April 2019	28 April 2019
6	noc19-cs27	Cloud Computing	8 Weeks	25 February 2019	19 April 2019	27 April 2019
7	noc19-cs28	Cryptography and Network Security	12 Weeks	28 January 2019	19 April 2019	27 April 2019

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8	noc19-cs31	Introduction to Internet of Things	12 Weeks	28 January 2019	19 April 2019	27 April 2019
9	noc19-ee20	Introduction to Photonics	12 Weeks	28 January 2019	19 April 2019	27 April 2019
10	noc19-ee12	Electronic Systems for Cancer Diagnosis	12 Weeks	28 January 2019	19 April 2019	28 April 2019
11	noc19-ee32	Electronic Modules for Industrial Applications using Op-Amps	8 Weeks	25 February 2019	19 April 2019	28 April 2019
12	noc19-mg26	Business analytics and data mining Modeling using R	12 Weeks	28 January 2019	19 April 2019	27 April 2019

Rules for offering NPTEL Courses as an alternate Program Electives with transfer of Credit.

NTR.1. These rules shall be applicable from Academic Year 2018-2019. They are prepared as per the Extraordinary Gazette, Part III – Section 4 Notification No. 332 dated August 22, 2016 and Curriculum Development Board, BIRLA VISHVAKARMA MAHAVIDYALAYA minutes of meeting point number CDB1718.3.4.

NTR.2. The NPTEL courses decided by the respective Board of Studies (BoS) shall be of Advanced or recent topics. They should not have similar or overlapping contents Vis- a-vis the core subjects offered by the respective BoS.

NTR.3. Each BoS, for its UG program, shall approve a list of around 5 to 15 (number as per their suitability) NPTEL subjects of 8 week and 12 week duration. These subjects shall be offered as an alternate to program electives of the respective branch offered in any semester from 5 to 8.

NTR.4. NPTEL Certifications of an 8 weeks course will be considered equivalent to a 3 or 4 credit elective, for awarding exemption.

NTR.5. NPTEL Certifications of a 12 weeks course will be considered equivalent to a 5 or 6 credit elective, for awarding exemption.

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NTR.6. NPTEL Certifications of two separate 8 weeks course will be considered equivalent to 5 or 6 credit elective, for awarding exemption.
NTR.7. NPTEL courses are not valid alternative to Open Elective.
NTR.8. NPTEL Certifications of any 4 weeks course will not be considered for credit transfer.

NTR.9. Students can register and give exam for these NPTEL courses in any semester from 5 to 8.

Sr. No.	Range of Percentage Marks obtained in NPTEL Exam	Equivalent Grade in BVM Autonomous
1	85-100	AA
2	70-84	AB
3	60-69	BB
4	55-59	BC
5	50-54	CC
6	45-49	CD
7	40-44	DD
8	0-39	FF

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AGENDA ITEM 5 : EC1819.2.5

AGENDA	DESCRIPTION
EC1718.2.5	To Approve Amendment Industry Project Guideline for Short Listed Students of Final Level of UG Programme. **(Annexture -V)**

Annexture – V

INDUSTRY PROJECT

4th Year, B. Tech. (Electronics and Communication)

Course Guidelines :

1. The Indusry Project shall exclusively be carried out at Industries/Organizations/Premier Institutes like IIT,ghandhinagar and SVNIT,Surat.Student shall physically be present at Industry/Organization/Premier Institute etc.
2. The Project shall be offered as an optional subject in the 8th semester of the Respective programmes and the credits of the project shall be equal to the total credits of the 8th Semester.
3. The maximum number of the students permitted for the Project shall be decided based on applications received from the students,DAC committee will shortlist applications, after looking at criteria maximum no of students allowed for industry project should not be more than 50 % of total strength of students in the semester .
4. Allocation of the students to Industries/Organizations/Premier Institutes shall be based on Merit Marks (i.e. CPI of the student). Details of the offering / selection of the industries etc. shall be decided by the Departmental Academic Committee (DAC). Subsequently, it shall be approved by the respective Board of Studies.

List of Industries/Organizations to be approved by DAC,EC

Sr. No	Name of Industry
	Matrix Telecom Solutions

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1	19-GIDC,Waghodia Dist. Vadodara-391 760, India
2	**Aimtron Foundation**, 1/A G.I.D.C. Estate, 2nd Floor ,Waghodia, Vadodara - 391760,Gujarat
3	**System Level Solutions (India) Pvt. Ltd** Plot#32, Zone-D/4, Phase-1, GIDC Estate,New V.V. Nagar - 388 121 Gujarat, India.,Anand
4	**Einfochips** Ahmedabad,Gujarat
5	**Leons' Integrations** Plot No 150,"Integration House", Ayodhyanagar,V.I.P. Road, Kareli Baugh, Vadodara, Gujarat, 390018, India
6	**Streebo Solutions Pvt. Ltd** A Floor, Siddhi Vinayak Tower, Off S.G. Highway, Makarba, Ahmedabad, India – 380051
7	**Helios Solutions** **Address** : 802 Iscon Atria 2, Gotri Road, Vadodara-390021, Gujarat **Contact Person** : Mr. Jaimin Sarvan **Website** : www.heliossolution.in **Area of Project Support for EC students**: Mobile Application Development PHP and E commerce application development.
8	**HashMedia** Contact Person: Mr. Harshit Lalpura **Website**: http://hashmedia.in/ **Area of Project Support for EC students** : Mobile Application ,PHP and E commerce application development. Biometrics Security System
9	***Indian Space Research Organisation (*ISRO*)*** Satellite Road,Ahmedabad – 380015 **www.sac.gov.in**
10	***BISAG - Bhaskaracharya Intitute for Space Applications and Geo-informatics*** Near CH '0' Circle, Indulal Yagnik Marg, Gandhinagar-Ahmedabad Highway, Gandhinagar-382 007 Gujarat, India **bisag.gujarat.gov.in**
11.	**Scopo** **Address:** B/405, Titanium Heights, Opp. Vodafone house, Corporate road, Makarba, Ahmedabad – 380015

	Website: www.scopo.in **Mobile:** +91-9724442054 **Area of Project Support for EC students** : Sensor based projects, Voice recognition system, touch switch – remote + mobile application based projects
12.	**Elcop Controls** **Address:** Plot No. 2/6-A, GIDC, Narmadanagar, Opp. GNFC Corporate Office, Bharuch 392015, Gujarat, India **Website**: www.elcopcontrols.com **Mobile:** +91-9824150551 **Landline:** 02642-248883 **Area of Project Support for EC students** : Power electronics, PLC based projects, Control engineering related projects.
13.	**AR Electronics** **Address:** 26/A, Safal Sumel 5, Chamunda Bridge, Chamanpura, Ahmedabad, Gujarat, India **Website:** www.arelectroworld.com **Area of Project Support for EC students:** Smart LED based street light, industrial light, smart bulb and various smart electronics based system.

5. Minimum two guides shall be appointed for each project. Among them, at least one shall be from Industry/Organization/Premier Institute/other College in which the project is undergone.
6. Student will not accept any stipend from industry in which student is carrying out the project.
7. Internal Guide/s shall closely monitor the progress of the Project.
8. Maximum teaching load of a faculty for guiding any form of Project (Internal Guide/s) shall not be more than four hrs/wk. Senior faculty, preferably, should not be assigned more than two hours/week of project load.
9. Internal Guide/s will be by default internal examiner/s.
10. Internal Guide/s will be by default internal examiner/s.
11. Each department shall appoint a course-coordinator to coordinate all projects.
12. The student/s shall present his/her/their progress of the project at-least two times in a semester as part of continuous evaluation. The presentation shall be evaluated by a committee formed by the DAC. The committee shall comprise of at-least two Faculty members from the same area, of the department, as well as the guide/s. The convener of the committee shall be a faculty other than guide/s of the student/s.
13. At the end of each semester, the Project shall be evaluated by the guide/s (internal examiner/s) and external examiner/s.
14. Distribution of marks for a Project in a semester shall be as follows.

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Continuous Evaluation (CE)	End Semester Examination (ESE)
40 %	60 %
Assessed in two presentations by the Committee suggested in point no. 12. Each evaluator has equal weightage in Assessment.	Assessed in the presentation made by the student at the end of semester by internal Examiner/s and external examiner/s. Internal examiner/s shall award 50% of ESE marks and external examiner/s shall Award 50% of ESE marks.

15. It is suggested that each Project is unique and shall be graded individually. Hence histogram shall be prepared for the Project. The guide line for grading the Project shall be made available in due course of time.
16. The inter-disciplinary projects are also encouraged.

Note: The point nos. 8 to 15 are to be proposed for the approval of the Academic Council of BVM. And hence, respective BOS are not supposed to alter them.

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Board of Studies Meeting

Annexure –VI

1. Following BoS, EC members were present in the meeting :

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	**Chairman**
2	Prof. K. R. Patel	Asst. Professor, EC, BVM	Secretary
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
4	Dr. D. C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member
6	Dr. P. S. Bhakhar	Asst. Professor, EC, BVM	Faculty Member
7	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member
8	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member
9	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member
10	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
11	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
12	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
13	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
14	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member
15	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)
16	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips, Ahmedabad	Representative from Industry

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ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHVAKARMA MAHVIDYALAYA
Date: 29-12-2018
Meeting of Board of Studies for Electronics & Communication Engineering Programme

Board of the Meeting

Sr. No.	Name of Member	Designation	Role in BoS	Sign
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	Chairman	
2	Prof. K. R. Patel	Asst. Professor, EC, BVM	Secretary	
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member	
4	Dr. D. C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member	
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member	
6	Dr. P. S. Bhakhar	Asst. Professor, EC, BVM	Faculty Member	
7	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member	
8	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member	
9	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member	
10	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member	
11	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member	
13	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member	
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member	
15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member	
16	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)	
17	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips, Ahmedabad	Representative from Industry	
18	Er. Meet Shah	Sr. DevOps Engineer, Einfochips, Ahmedabad	Post Graduate Alumnus	
19	Prof. Usha Nilkanthan	Head & Professor, LD College	VC Nominee	
20	Dr. Mehul Raval	Professor, PDPU, Gandhinagar	Expert in the subject (Outside College)	

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HOD

Electronics & Communication
Birla Vishvakarma Mahavidyalaya
Engg. Campus
Vallabh Vidyanagar

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Board of Studies (BoS) meeting of B.Tech Electronics and Communication Engineering Programme, BVM (Under Autonomous scheme), is was at 10:30 AM on the 27 - 04 - 2019 for the following agenda items :

Agenda of the Meeting

EC1920.1.1	To approve minutes of board of studies (BoS) meeting held on 29-12-2018.
EC1920.1.2 (a)	To Discuss and Approve Amendment in Teaching Structure of **First Level** of B.Tech Programme, Particularly for Commonly Offered Courses as per Our Curriculum Development Board (CDB) Guidelines. (Annexure – I)
(b)	To Discuss and Approve Amendment in Teaching Structure of **Second, Third & Final Level** of B.Tech Programme, particularly for Commonly Offered Courses as per Our Curriculum Development Board (CDB) Guidelines. (Annexure – II)
EC1920.1.3	To Discuss on implementation of Internship in vacation for all disciplines as per the AICTE and our Curriculum Development Board (CDB) guidelines.

Following suggestions and decisions were made confidentially with regards to the Agenda of the meeting after detailed discussions in the meeting :

Sr. No.	**Expert Name**	**BoS**	**Suggestions & Approval.**
1.1	Prof. K. R. Patel	EC BoS	Today's meeting was started at 10:30 A.M in the presence of BoS experts .
1.2	Dr. B. C. Goradiya	EC BoS	Started discussing MoM of Previous BoS meeting held on 29.12.2018
1.3	Dr. B. C. Goradiya	EC BoS	He discussed the involvement of various subjects like scripting languages, Perl scripting as per the industrial need .also discussed revised 1st level structure & other agendas of Previous BoS meeting held on 29.12.2018.
1.4	Dr. Mehul Raval , Er, Krunal Patel .	EC BoS	We can include C++ course directly in to 1st level . Dr. B. C. Goradiya clarified inclusion of C and C++ programming courses in first level along with other first level courses.
1.5	Dr. B. C. Goradiya	EC BoS	He discussed 2nd level course structure and syllabus. Later on he discussed 3rd level and final level teaching Structure proposed and approved in BoS meeting of 29th Dec 2018.

1.6	Dr. Mehul Raval, Er. Krunal Patel	EC BoS	Finally approved Minutes of board of studies (BoS) meeting held on 29-12-2018
1.7	Dr. B. C. Goradiya	EC BoS	Started discussing Amendment in Teaching Structure of **First Level** of B.Tech Programme, Particularly for Commonly Offered Courses as per Our Curriculum Development Board (CDB) Guidelines. (Agenda item 2 (a)).
1.8	Dr. Mehul Raval	EC BoS	He advised to sequentialize Linear algebra and Fourier transform contents for adaptive filtering , Signal Processing , machine learning subjects .We can include probability and statistics in differential equation and Statistics Course .
1.9	Dr. Mehul Raval , Er. Krunal Patel	EC BoS	They emphasis on Application specific math .we can invite experienced math faculty in department premises for teaching Application specific contents to students .
2.0	Dr. B. C. Goradiya	EC BoS	Started discussing amendment in 2^{nd} ,3^{rd} and 4^{th} level teaching structure .He discussed the amendment in Structure of programme electives (Combining theory and Lab Courses as single course)
2.1	Dr. Mehul Raval	EC BoS	He advised to merge Analog and Digital Communication, Microprocessor and Microcontroller Courses as single course. He suggested to teach RTOS first then Microprocessor Architect .
2.2	Dr. Mehul Raval, Prof. H. J. Patel	EC BoS	They discussed contents of Microcontroller Courses.
2.3	Dr. B. C. Goradiya with other BoS members .	EC BoS	Started discussing implementation of Internship in summer vacation of 2^{nd} and 3^{rd} Level .Finally two were finalized for internship. Students will claim this MC – internship course in next upcoming semester .
2.4	Dr. Mehul Raval , Er. Krunal Patel	EC BoS	They advised to invite industry expert for 2 to 3 weeks at college and department premises .
2.5	Dr. B. C. Goradiya	EC BoS	Minor degree Provision was discussed & approved other BoS members in the meeting.

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AGENDA ITEM No. 2(a) : EC1920.1.2 (a)

AGENDA	DESCRIPTION
EC1920.1.2 (a)	To Discuss and Approve **Amendment in** Teaching Structure of **First Level** B.Tech Programme, Particularly for Commonly Offered Courses as per Our Curriculum Development Board (CDB) Guidelines.

Teaching Structure of 1st Level B. Tech (Electronics and Communication Programme) under BVM Autonomous Scheme w.e.f. Academic Year **2018 - 19** (Proposed and approved in BoS Meeting of July 2018).

Electronics and Communication Engineering Department
Course Structure (Academic Year 2018-2019)

Semester – I

Sr. No.	Course Code	Course Title	L	T	P	H	C
	Mandatory	Induction program of 3 weeks					
1	BS101	Advanced Calculus	3	2	0	5	5
2	BS104	Semiconductor Physics	3	0	2	5	4
3	ES102	Electronics Workshop	0	0	2	2	1
4	ES101	Basic Electronics	3	0	2	5	4
5	HS101	English	2	0	2	4	3
6	HS102	Environmental Science (Mandatory Non Credit Course – MC)	2	2	0	4	0
7	HS103	Introduction to EC Department	0	0	2	2	1
		Total	**13**	**04**	**10**	**27**	**18**

Semester - II

Sr. No.	Course Code	Course Title	L	T	P	H	C
1.	BS102	Linear Algebra and Fourier Series	3	2	0	5	5
2.	ES103	Basic Electrical Engineering	3	0	2	5	4
3.	ES105	Programming for Problem Solving	3	0	2	5	4
4.	ES109	Engineering Graphics & Design	2	0	4	6	4
5.	ES112	Basics of Manufacturing Practices	0	0	2	2	1
6.	ES117	Introduction to Digital Electronics	1	0	2	3	2
		Total	**12**	**02**	**12**	**26**	**20**

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Vallabh Vidyanagar – 388120
Gujarat, India

Annexure – I

Amendment in Teaching Structure of 1st Level of B.Tech Programme, Particularly for Commonly Offered Courses as per Curriculum Development Board (CDB) Guidelines w.e.f. A.Y. **2019 – 2020.**

Electronics and Communication Engineering Department
Course Structure (Academic Year 2019 – 2020)

Semester – I

Sr. No.	Course Code	Course Title	L	T	P	H	C
	Mandatory	Induction program of 3 weeks					
1.	BS101	Advanced Calculus	3	1	0	4	4
2.	BS104	Semiconductor Physics	3	0	2	5	4
3.	ES102	Electronics Workshop	0	0	2	2	1
4.	ES101	Basic Electronics	3	0	2	5	4
5.	HS101	English	2	0	2	4	3
6.	HS102	Environmental Science (Mandatory Non Credit Course – MC)	2	0	0	2	0
7.	HS103	Introduction to EC Department	0	0	2	2	1
		Total	**13**	**01**	**10**	**24**	**17**

Semester - II

Sr. No.	Course Code	Course Title	L	T	P	H	C
1.	BS102	Linear Algebra and Fourier Series	3	1	0	4	4
2.	ES103	Basic Electrical Engineering	3	0	2	5	4
3.	ES105	Programming for Problem Solving	3	0	2	5	4
4.	ES109	Engineering Graphics & Design	2	0	4	6	4
5.	ES112	Basics of Manufacturing Practices	0	0	2	2	1
6.	ES117	Introduction to Digital Electronics	1	0	2	3	2
		Total	**12**	**01**	**12**	**25**	**19**

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
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Gujarat, India

AGENDA ITEM No. 2(b) : EC1920.1.2(b)

AGENDA ITEM	DESCRIPTION
EC1920.1.2 (b)	To Discuss and Approve Amendment in Teaching Structure of **Second, Third & Final Level** of B.Tech Programme, Particularly for Commonly Offered Courses as per Our Curriculum Development Board (CDB) Guidelines. (Annexure – II)

Electronics and Communication Engineering Department
Course Structure (Old Structure as per BoS Meeting on 29/12/2018)

Semester – III

Sr. No.	Course Code	Course Title	L	T	P	H	C
1.	BS	Advance Engineering Mathematics	3	0	0	3	3
2.	BS	Network Theory	3	1	0	4	4
3.	PC	Electronic Devices and Circuits	3	0	0	3	3
4.	PC	Electronic Devices and Circuits Lab	0	0	2	2	1
5.	PC	Digital System Design	3	0	0	3	3
6.	PC	Digital System Design Lab	0	0	2	2	1
7.	PC	Object Oriented Programming	3	0	0	3	3
8.	PC	Object Oriented Programming Lab	0	0	2	2	1
9.	ES	Simulation and Design Tools	0	0	2	2	1
10	HS	Professional Soft Skills	1	0	2	3	2
		Total	16	1	10	27	22

Semester – IV

Sr. No.	Course Code	Course Title	L	T	P	H	C
1.	HS	Engineering Economics and Management (Title need to be decided at institute level)	3	0	0	3	3
2.	PC	Signals & Systems	3	0	0	3	3
3.	PC	Signals & Systems Lab	0	0	2	2	1
4.	ES	Control Systems	3	0	0	3	3
5.	ES	Control Systems Lab	0	0	2	2	1
6.	PC	Analog Communication	3	0	0	3	3

7.	PC	Analog Communication Lab	0	0	2	2	1
8.	PC	Microprocessor and Computer Architecture	3	0	0	3	3
9.	PC	Microprocessor and Interfacing Lab	0	0	2	2	1
10.	PC	Electronic Measurements and Instruments	3	0	0	3	3
11.	PC	Electronic Measurements and Instruments Lab	0	0	2	2	1
12.	PW	Mini Project	0	0	2	2	1
		Total	18	0	12	30	24

Semester V

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	HS	Constitution of India (Mandatory Course - MC) – Included after CDB meeting of 07.02.2019	2	0	0	2	0
2.	PC	Electromagnetics Theory	3	0	0	3	3
3.	PC	Microcontroller and Applications	3	0	0	3	3
4.	PC	Microcontroller and Applications Lab	0	0	2	2	1
5.	PC	CMOS Digital Integrated Circuits	3	0	0	3	3
6.	PC	CMOS Digital Integrated Circuits Lab	0	0	2	2	1
		Programme Elective – I (Separate Thoery and Lab Course was Proposed Earlier)	3	0	2	5	4
7.	PE	Power Electronics					
8.	PE	Digital Design Using HDL					
9.	PE	Industrial Automation					
		Open Elective – I	3	0	2	5	4
10.	OE	Introduction to Cellular Communication					
11.	OE	Applied Electronics					
		Total	**17**	**0**	**8**	**25**	**19**

Semester VI

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	PC	Digital Communication	3	0	0	3	3
2.	PC	Digital Communication Lab	0	0	2	2	1
3.	PC	Antennas and Wave Propogation	3	0	0	3	3
4.	PC	Antennas and Wave Propogation Lab	0	0	2	2	1

5.	PC	Advance Microcontroller	2	0	0	2	2
6.	PC	Advance Microcontroller Lab	0	0	2	2	1
7.	PC	Digital Signal Processing	3	0	0	3	3
8.	PC	Digital Signal Processing Lab	0	0	2	2	1
9.	PC	Scripting Languages	0	0	2	2	1
		Programme Elective – II (Separate Thoery and Lab Course was Proposed Earlier)	3	0	0	3	3
10.	PE	Introduction to Real Time Operating System					
11.	PE	Optical Fiber Communication					
12.	PE	Satellite Communication					
		Open Elective – II	3	0	0	3	3
13.	OE	Embedded Systems and IOT					
		Total	**17**	**0**	**10**	**27**	**22**

Semester – VII

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	PC	Computer Networks	3	0	0	3	3
2.	PC	Computer Networks Lab	0	0	2	2	1
3.	PC	Wireless Communication	3	0	0	3	3
4.	PC	Wireless Communication Lab	0	0	2	2	1
5.	PC	Embedded System Design with IOT	3	0	0	3	3
6.	PC	Embedded System Design with IOT Lab	0	0	2	2	1
7.	PW	Guided Research	0	0	4	4	2
8.	PC	Electronic Product Design	0	0	2	2	1
		Programme Elective – III (Separate Theory and Lab Course were Proposed Earlier)	3	0	2	5	4
9.	PE	Digital Image Processing					
10.	PE	Bio Medical Instrumentation					
11.	PE	RF and Microwave Engineering					
		Total	12	0	14	26	19

Semester – VIII

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	PW	Project	0	0	18	18	9

		Programme Elective – IV (Separate Thoery and Lab Course was Proposed Earlier)	3	0	2	5	4
2.	PE	Radar & Navigational Aids					
3.	PE	Machine Learning					
4.	PE	Advance Communication Systems					
		Programme Elective – V	1	0	2	3	2
5.	PE	Virtual Instrumentation					
6.	PE	Device Driver Development					
7.	PE	Android Programming					
		Total	**4**	**0**	**22**	**26**	**15**
OR							
		Semester – VIII	**L**	**T**	**P**	**H**	**C**
1.	PW	Industry Project	**0**	**0**	**30**	**30**	**15**

Annexure – II

Electronics and Communication Engineering Department
Course Structure (New Structure)

Semester - III

Sr. No.	Course Code	Course Title	L	T	P	H	C
1.	BS	Differential Equation & Statistics	3	1	0	4	4
2.	BS	Network Theory	3	1	0	4	4
3.	PC	Electronic Devices and Circuits	3	0	0	3	3
4.	PC	Electronic Devices and Circuits Lab	0	0	2	2	1
5.	PC	Digital System Design	3	0	0	3	3
6.	PC	Digital System Design Lab	0	0	2	2	1
7.	PC	Object Oriented Programming	3	0	0	3	3
8.	PC	Object Oriented Programming Lab	0	0	2	2	1
9.	ES	Simulation and Design Tools	0	0	2	2	1
10.	HS	Professional Soft Skills	1	0	2	3	2
		Total	16	2	10	28	23

Semester – IV

Sr. No.	Course Code	Course Title	L	T	P	H	C

1.	HS	Economics and Management For Engineers	3	0	0	3	3
2.	PC	Signals & Systems	3	0	0	3	3
3.	PC	Signals & Systems Lab	0	0	2	2	1
4.	ES	Control Systems	3	0	0	3	3
5.	ES	Control Systems Lab	0	0	2	2	1
6.	PC	Analog Communication	3	0	0	3	3
7.	PC	Analog Communication Lab	0	0	2	2	1
8.	PC	Microprocessor and Computer Architecture	3	0	0	3	3
9.	PC	Microprocessor and Interfacing Lab	0	0	2	2	1
10.	PC	Electronic Measurements and Instruments	3	0	0	3	3
11.	PC	Electronic Measurements and Instruments Lab	0	0	2	2	1
12.	PW	Mini Project	0	0	2	2	1
		Total	18	0	12	30	24

(It was decided to combine Thoery and Lab Course for Programme Electives in CDB meeting of 07.02.2019)

Semester - V

Sr. No	Course Code	Name of Course	L	T	P	H	C
	MC	Internship of 2 weeks	-	-	-	-	-
1.	HS	Ethics and Constitution (Mandatory Non Credit Course – MC)	2	0	0	2	0
2.	PC	Electromagnetics Theory	3	0	0	3	3
3.	PC	Microcontroller and Applications	3	0	0	3	3
4.	PC	Microcontroller and Applications Lab	0	0	2	2	1
5.	PC	CMOS Digital Integrated Circuits	3	0	0	3	3
6.	PC	CMOS Digital Integrated Circuits Lab	0	0	2	2	1
		Programme Elective – I	3	0	2	5	4
7.	PE	Power Electronics					
8.	PE	Digital Design Using HDL					
9.	PE	Industrial Automation					
		Open Elective – I	3	0	2	5	4
10.	OE	Introduction to Cellular Communication					
11.	OE	Applied Electronics					
		Total	**17**	**0**	**8**	**25**	**19**

Semester VI

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	PC	Digital Communication	3	0	0	3	3
2.	PC	Digital Communication Lab	0	0	2	2	1
3.	PC	Antennas and Wave Propogation	3	0	0	3	3
4.	PC	Antennas and Wave Propogation Lab	0	0	2	2	1
5.	PC	Advance Microcontroller	2	0	0	2	2
6.	PC	Advance Microcontroller Lab	0	0	2	2	1
7.	PC	Digital Signal Processing	3	0	0	3	3
8.	PC	Digital Signal Processing Lab	0	0	2	2	1
9.	PC	Scripting Languages	0	0	2	2	1
		Programme Elective – II	**3**	**0**	**0**	**3**	**3**
10.	PE	Introduction to Real Time Operating System					
11.	PE	Optical Fiber Communication					
12.	PE	Satellite Communication					
		Open Elective – II	3	0	0	3	3
13.	OE	Embedded Systems and IOT					
		Total	**17**	**0**	**10**	**27**	**22**

Semester – VII

Sr. No	Course Code	Name of Course	L	T	P	H	C
	MC	Internship of 2 Weeks	-	-	-	-	-
1.	PC	Computer Networks	3	0	0	3	3
2.	PC	Computer Networks Lab	0	0	2	2	1
3.	PC	Wireless Communication	3	0	0	3	3
4.	PC	Wireless Communication Lab	0	0	2	2	1
5.	PC	Embeded System Design with IOT	3	0	0	3	3
6.	PC	Embeded System Design with IOT Lab	0	0	2	2	1
7.	PW	Guided Research	0	0	4	4	2
8.	PC	Electronic Product Design	0	0	2	2	1
		Programme Elective – III	3	0	2	5	4
9.	PE	Digital Image Processing					
10.	PE	Bio Medical Instrumentation					
11.	PE	RF and Microwave Engineering					
		Total	**12**	**0**	**14**	**26**	**19**

Semester – VIII

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	PW	Project	0	0	18	18	9
		Programme Elective – IV	3	0	2	5	4
2.	PE	Radar & Navigational Aids					
3.	PE	Machine Learning					
4.	PE	Advance Communication Systems					
		Programme Elective – V	1	0	2	3	2
5.	PE	Virtual Instrumentation					
6.	PE	Device Driver Development					
7.	PE	Android Programming					
		Total	**4**	**0**	**22**	**26**	**15**
OR							
		Semester – VIII	**L**	**T**	**P**	**H**	**C**
1.	PW	Industry Project	0	0	30	30	15

Semester wise Credit Distribution of Courses

It is suggested and proposed by CDB that no theory component for any course should exceed 3 hours per week. All board of studies are requested to prepare the structure of studies for Maximum 160 credits.

Academic Year 2018 - 19

SEM	HS	BS	ES	PC	PE	OE	PW	MC	CREDITS	HRS
1	4	9	5	-	-	-	-	4 Hr	18	27
2	0	5	15	-	-	-	-	-	20	25
3	2	8	1	12	-	-	-	-	23	28
4	3	-	4	16	-	-	1	-	24	30
5	-	-	-	11	4	4	-	2 Hr	19	25
6	-	-	-	16	3	3	-	-	22	27
7	-	-	-	13	4	-	2	-	19	26
8	-	-	-	-	6	-	9	-	15	26
Total	**09**	**22**	**25**	**68**	**17**	**7**	**12**	**6 Hr**	**160**	**214**

Academic Year 2019 - 20

SEM	HS	BS	ES	PC	PE	OE	PW	MC	CREDIT	HR
1	4	8	5	-	-	-	-	2 Hr	17	24
2	0	4	15	-	-	-	-	-	19	25
3	2	8	1	12	-	-	-	-	23	28
4	3	-	4	16	-	-	1	-	24	30

5	-	-	-	11	4	4	-	2 Hr	19	25
6	-	-	-	16	3	3	-	-	22	27
7	-	-	-	13	4	-	2	-	19	26
8	-	-	-	-	6	-	9	-	15	26
Total	**09**	**20**	**25**	**68**	**17**	**7**	**12**	**4 Hr**	**158**	**211**

HS = Humanities and Science, BS = Basic Science, ES = Engineering Science, PC = Professional Core Courses, OE = Open Electives, PW = Project Work, Seminar and Internship, MC = Mandatory Non Credit Course

AGENDA ITEM No. 3 : EC1920.1.3

AGENDA ITEM	DESCRIPTION
EC1920.1.3	To Discuss on implementation of Internship in vacation for all disciplines as per the AICTE and our CDB guidelines.

With reference to Minutes of CDB meeting held on 07.02.2019 (Agenda CDB1819.8.1) in Principal Office – Board Room, the following agenda was discussed.

(I) There shall be two Non-Credit Mandatory Internship courses offered in B.Tech Programme by our BoS in summer vacation of 2nd and 3rd Level each.
(II) Each internship Course should be of two weeks.

Additional Note: College will offer minor degree to students if Student has completed minimum 20 credits of courses offered by respective discipline of the college. Student has to enroll between 3rd to 8th semester to get minor degree. Finally, Minor degree Provision was discussed & approved by other members in the BoS meeting.

HOD

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
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Gujarat, India

Board of Studies Meeting

Annexure – III

Following BoS, EC members were present in the meeting ;

Sr. No.	Name of Member	Designation	Role in BoS
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	Chairman
2	Prof. K. R. Patel	Asst. Professor, EC, BVM	Secretary
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
4	Dr. D. C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member
6	Dr. P. S. Bhakhar	Asst. Professor, EC, BVM	Faculty Member
7	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member
8	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member
9	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member
10	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
11	Dr. Sandip Unadkat	Asst. Professor, EC, BVM	Faculty Member
12	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
13	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
15	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)
16	Dr. Mehul Raval	Professor ,PDPU ,Gandhinagar	Expert in the subject (Outside College)

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Vallabh Vidyanagar-388

Dr. B. C. Goradiya
Chairman, BoS, EC
BVM (Autonomous)

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
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Gujarat, India

ELECTRONICS & COMMUNICATION DEPARTMENT (SFI)
BIRLA VISHVAKARMA MAHAVIDYALAYA

Date: 27-04-2019

Meeting of Board of Studies for Electronics & Communication Engineering Programme

Board of the Meeting

Sr. No.	Name of Member	Designation	Role in BoS	Sign
		Faculty Members of EC Department		
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	Chairman	
2	Prof. K. R. Patel	Asst. Professor, EC, BVM	Secretary	
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member	
4	Dr. D. C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member	
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member	
6	Dr. P. S. Bhakhar	Asst. Professor, EC, BVM	Faculty Member	
7	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member	
8	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member	
9	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member	
10	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member	
11	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member	
13	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member	
14	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member	
15	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member	-AB-
		External Experts		
1	Prof. Usha Nilkanthan	Head & Professor, LD College	VC Nominee	-AB-
2	Dr. Mehul Raval	Professor, PDPU, Gandhinagar	Expert in the subject (Outside College)	27.4.19
3	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips, Ahmedabad	Representative from Industry	-AB-
4	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)	
5	Er. Meet Shah	Sr. DevOps Engineer, Einfochips, Ahmedabad	Post Graduate Alumnus	-AB-

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ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

Board of Studies (BoS) meeting of B.Tech Electronics and Communication Engineering Programme, BVM (Under Autonomous scheme), is held at **10:30 AM** on the **21 - 12 - 2019** for the following agenda items :

Agenda of the Meeting

EC1920.2.1	To Discuss, Suggest and Approve detail syllabus of **Third Level** of UG Programme as per the New AICTE UG Curriculum Guideline (Annexure – I).
EC1920.2.2	To approve the amendment in NPTEL/MOOC courses credit transfer/ exemptions (Annexure – II).
EC1920.2.3	To approve additional Industries/Organizations for full semester (8^{th} semester) Industry Project (Annexure – III).

Following BoS, EC members were present in the meeting:

Sr. No.	Name of Member	Designation	Role in BoS
Faculty Members of EC Department			
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	**Chairman**
2	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
3	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member
4	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member
5	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member
6	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member
7	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
8	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member
9	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
10	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
11	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
12	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member
External Experts			
1	Dr. Mehul Raval	Professor, PDPU ,Gandhinagar	Expert in the subject (Outside College)
2	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips , Ahmedabad	Representative from Industry
3	Er. Krunal Patel	Project Manager , SLS	Expert in the subject (Outside College)

Following BoS, EC members were absent in the meeting :

Sr. No.	Name of Member	Designation	Role in BoS
Faculty Members of EC Department			
1	Prof. K.R.Patel	Asst. Professor, EC, BVM	Secretary
2	Dr. D.C.Dalwadi	Asso. Professor, EC, BVM	Faculty Member
External Experts			
1	Prof. Usha Nilkanthan	Head & Professor,LD College	VC Nominee
2	Er. Meet Shah	Sr.DevOps,Engineer,Einfochips, Ahmedabad	Post Graduate Alumnus

Following suggestions and decisions were made confidentially with regards to
The Agenda of the meeting after detailed discussions in the meeting :

Agenda : 01

- Meeting was addressed by Dr.B.C.Goradiya in the presence of Dr. Mehul Raval, Er. Nilesh Ranpura and Er.Krunal patel, EC staff members .
- Introduction to EC department was discussed with experts.
- Discussion of application of mathematics was done as part of signal system and maths common things.
- Er. Nilesh Ranpura discussed about time for internship training and suggested that the certificate criteria must be eliminated but Dr. B.C. Goradiya asked for authentication of training.
- Er.krunal patel suggested two weeks of training regarding electronics components and manufacturing
- He suggested to sensitize student to industry environment.
- Two week of workshop was suggested by Er.Krunal Patel.
- Email from mentor or project coordinator will be sufficient in place of certificate that was suggested by Er.Ranpura
- 2 days for industry+4 days of college (Combined internship) was suggested
- Dr. Mehul Raval suggested that department must convey his requirement to industry as well as Industries must be visited by various faculties.
- Dr. B.C.Goradiya assured that department specific guidelines will be formed.
- Dr. Mehul Raval and Er. Ranpura shared example of Webex.
- Dr.B.C.Goradiya presented list of 5^{th} and 6^{th} semester subjects.
- Dr. Mehul raval asked for inter linking between antenna and wave propagation , Dr.B.C.Goradiya told about linking of above mention subjects.

3 EC 01: Electromagnetics Thoery

- Prof. G.B. Rathod presented the subject.
- Prof. R.R. Vashi presented Antenna Syllabi.

- Dr. B.C. Goradiya appreciated the set up antenna testing lab that matched with industry.
- Dr. Mehul Raval asked for Antenna of 5G standard and 3G,4G power requirement to be added in syllabus.

3EC02 : Microcontroller and Applications

- Prof H. J. Patel presented the subject contents.
- Er. Krunal Patel suggested architecture of controller to cover in microprocessor subjects. No of hours may be added to last chapters.
- Er. Ranpura, Er. Krunal and Dr. Raval asked for conventional program methods as only Arduino is academic purpose.

3EC10: Advance Microcontroller

- Prof A.A.Vahora presneted ARM Syllabi.
- Dr. Raval suggested two subjects of micro controller and one for embedded systems.
- He also suggested to cover Arduino in Basic Electronics .
- Er. Ranpura appreciated product design and prototype course .
- He suggested industry people to take some modules of the subjects
- Dr. B.C. Goradiya suggested OEP to take it to POC level.

3EC04 : CMOS Digital Integrated Circuits

- Prof R.P.Paul presented the subject.
- Er. Ranpura suggested MOS and FET in 6th module of the subject and include industrial standard in the subjects
- Experts also suggested CMOS to be covered in Basic Electronics.

3EC42 : Digital Design Using HDL

- Prof R.P. Paul presented the subject.
- Er. Ranpura suggest to switch to Verilog as VHDL is obsolete from industries
- Experts also suggested to introduce Verilog to Digital logic design for FSM

3EC43 : Industrial Automation

- Prof. Palak Patel presented the subject
- Er.Krunal patel suggested I2C Protocol, Ethernet introduction HMI,SCADA,PLC
- Dr.B.C.Goradiya suggested to include current trends and industry 4.0

3EC41 : Power Electronics

- Prof. A.B.Bambhaniya presneted the subject
- Er. Krunal Patel suggested application for this subject
- In Module 06, Solar inverter need to be added
- Experts suggested to include case studies of Electric vehicles.

3EC81 : Introduction to Cellular Communication

- Dr. R.C.Rana presented subject
- Dr. Mehul Raval suggested to add case studies

- Er. Nilesh Ranpura and Dr. Raval suggested to rectify unit 03 and unit 04.
- Experts suggested titles as Communication Engineering for all or Wireless communication.

3EC82 : Applied Electronics

- Prof Mayur Sevak presneted the subject
- Experts suggested to add Arduino hands on session and plug and play platforms
- Experts suggested that how electronics is used for other branches

3 EC 06 : Digital Communication

- Prof. Mayur Sevak presneted the subject.
- Experts suggested to add probability to add in analog communication
- Case studies and SDR may be added

3 EC 12 : Digital Signal Processing

- Er.Krunal Patel asked for DSP subject title
- Dr.B.C.Goradiya introduce it as requirement of image processing and Machine learning
- Open ended problem must be added to at starting of the subject
- Prof Raval suggested to add DSP processor and architecture and Code Composer Studio.

3EC14 : Scriptng Language

- Prof A.A.Vahora presneted the subject
- Experts suggested extra programs can be added

3EC44 : Introduction to RTOS

- Prof A.A.Vahora presneted the subject
- Experts suggested to add peripherals, effects of changing inputs and three BIOS

3EC45 : Optical Fiber Communication

- Prof R.R.Vashi presneted subjects
- Experts suggests to add Li-fi case studies .

3EC46 : Satellite Communication

- Prof Mayur Sevak presneted the subject.
- Experts suggested case studies to be mapped with applications.

Agenda : 02

- Dr.B.C.Goradiya presneted quality assurance and credit transfer rules of NPTEL
- Minor B.Tech degree course NPTEL was briefed.

Agenda : 03

- Dr.B.C.Goradiya presneted new list of companies relates to EC branch
- Experts suggested faculty to visit industry for review of process

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

AGENDA ITEM No. 1 : EC1920.2.1

AGENDA ITEM	DESCRIPTION
EC1920.2.1	To Discuss, Suggest and Approve detail syllabus of **Third Level** of UG Programme as per the New AICTE UG Curriculum Guideline (Annexure – I).

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Annexure-I

Teaching Structure of 3rd Level B.Tech (Electronics and Communication Programme) under BVM Autonomous Scheme w.e.f. Academic Year **2020 -2021** for 2018-19 Batch. (Proposed and Approved in BoS Meeting of April 2019).

Electronics and Communication Engineering Department
Course Structure (Academic Year 2020-2021)

Semester – V

Sr. No	Course Code	Name of Course	L	T	P	H	C
		Semester - V					
1	3HS01	Ethics and Constitution of India	2	0	0	2	0
2	3EC01	Electromagnetics Theory	3	0	0	3	3
3	3EC02	Microcontroller and Applications	3	0	0	3	3
4	3EC03	Microcontroller and Applications Lab	0	0	2	2	1
5	3EC04	CMOS Digital Integrated Circuits	3	0	0	3	3
6	3EC05	CMOS Digital Integrated Circuits Lab	0	0	2	2	1
		Programme Elective – I	3	0	2	5	4
1	3EC41	Power Electronics					
2	3EC42	Digital Design Using HDL					
3	3EC43	Industrial Automation					
		Open Elective – I	3	0	2	5	4
1	3EC81	Introduction to Cellular Communication					
2	3EC82	Applied Electronics					

		Total	**17**	**0**	**8**	**25**	**19**
		Semester – VI					
1	3EC06	Digital Communication	3	0	0	3	3
2	3EC07	Digital Communication Lab	0	0	2	2	1
3	3EC08	Antennas and Wave Propogation	3	0	0	3	3
4	3EC09	Antennas and Wave Propogation Lab	0	0	2	2	1
5	3EC10	Advance Microcontroller	2	0	0	2	2
6	3EC11	Advance Microcontroller Lab	0	0	2	2	1
7	3EC12	Digital Signal Processing	3	0	0	3	3
8	3EC13	Digital Signal Processing Lab	0	0	2	2	1
9	3EC14	Scripting Languages	0	0	2	2	1
		Programme Elective – II	3	0	0	3	3
1	3EC44	Introduction to Real Time Operating System					
2	3EC45	Optical Fiber Communication					
3	3EC46	Satellite Communication					
		Open Elective – II	3	0	0	3	3
1	3EC83	Embedded Systems and IOT					
		Total	**17**	**0**	**10**	**27**	**22**

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Gujarat, India

3EC01: Electromagnetics Theory
CREDITS - 3 (L=3, T=0, P=0)
3rd Year, B. Tech. (Electronics and Communication)

Course Objective :

To provide a strong knowledge of basic principles, laws, and Theorems of electromagnetism to understand transmission, radiation, and propagation for physical interpretation and applications.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component:

Internal Exams [30 Marks]	Countious Assesments/ALA [10 Marks]
Mid Sem Internal Exams	Attendance /Assignments / Quiz

***ALA: Active Learning Assignments**

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage %
1	**Vector Calculus, Coordinates systems, and Transformation:** Scalar and Vector quantities and its addition, subtraction, and multiplication, Unit vector, Cartesian, Cylindrical and Spherical coordinate systems, Transformation between Coordinate systems.	05	10%
2	**Electrostatics :** Different types of charge distribution(Charge Family), Coulomb's law, Electric field intensity due to different charge distributions, Streamlines, Electric flux density, Gauss's law and its application, Divergence, Divergence theorem, Del operator, Maxwell's first equation.	07	15%
3	**Energy and Potential :** Energy Expended in Moving a Point Charge in an Electric Field, The Line Integral, Definition of Potential Difference and Potential, The Potential Field of a Point	07	15%

	Charge, The Potential Field of a System of Charges: Conservative Property, Potential Gradient, The Electric Dipole, Energy Density in the Electrostatic Field. Poisson's and Laplace's Equations, Examples and Solution of Laplace's Equation, Example of the Solution of Poisson's Equation		
4	**Conductors and Dielectrics :** Current and Current Density, Continuity of Current, Conductor Properties, Nature of Dielectric Materials, Boundary Condition between ideal conductor and perfect dielectric, Boundary Conditions between Perfect Dielectric Materials. Capacitance for parallel plates.	07	15%
5	**Magneto-statics :** Continuity equation, Biot-Savart law, Ampere's circuital law, and its applications, Magnetic Flux and Magnetic Flux Density, Curl, Stokes theorem, Expression for stored energy in the magneto-static field, Scalar and Vector Magnetic Potential, Magnetic boundary condition.	07	15%
6	**Magnetic Forces, Materials, Inductance and Maxwell' Equations :** Force on a Moving Charge, Force on a Differential Current Element, Hall Effect, Force between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials	12	30%
	Total	45	100 %

List of References :

1. William H Hayt and John A Buck, "*Engineering Electromagnetics*", McGraw-Hill Publication, Eighth Edition,2014.
2. Matthew N. O. Sadiku, "*Principles of Electromagnetics*", Sixth Edition, Oxford university press, 2015.
3. J.D.Kraus and Daniel Fleisch, "*Electromagnetics applications*", Fifth Edition, McGraw Hill Pub.,2010.
4. Karl Erik Lonngren, Sava VasilevSavov, "*Fundamentals of Electromagnetics with MATLAB*",Second Edition, Sci-Tech Publishing,2007.

Course Outcomes (COs) :

By learning this course student will be able to……

1. Understand the coordinate systems for the vector and scalar parameters.
2. Apply the basic principles of the Electric and Magnetic fields.

3. Understand the concept of potential and energy along with conductors and dielectric materials.
4. Analyze the electromagnetic waves using divergence, Curl and stock's theorem.
5. Design and test the properties of the magnetic materials and their parameters.
6. Evaluate EM waves using Maxwell's, Poisson's and Laplace equations.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC01.1	3	3	3	2	2	1	-	-	-	-	-	3	3	2	2
3EC01.2	3	3	3	1	2	2	1	-	-	-	-	3	3	1	2
3EC01.3	3	3	3	1	1	1	1	-	-	-	-	3	3	-	2
3EC01.4	3	3	3	2	1	1	1	-	-	-	-	3	3	1	2
3EC01.5	3	3	3	3	2	2	2	-	-	-	-	3	3	1	3
3EC01.6	*3*	*3*	*3*	*2*	*2*	*2*	*2*	-	-	-	-	*3*	*3*	*2*	*2*
Average	3	3	3	1.8	1.6	1.5	1.4	-	-	-	-	3	3	1.4	2.1

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	3EC01.1	**Exam, Assignments, Presentation, Quiz**
2.	3EC01.2	**Exam, Assignments, Presentation, Quiz**
3.	3EC01.3	**Exam, Assignments, Presentation, Quiz**
4.	3EC01.4	**Exam, Assignments, Presentation, Quiz**
5.	3EC01.5	**Exam, Assignment, Presentation, Quiz**
6.	3EC01.6	**Exam, Assignments, Presentation, Quiz**

Suggested specification table with marks (Theory) :

Distribution of Theory Marks %					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

3EC02: Microcontroller and Applications

CREDITS – 3 (L=3, T=0, P=0)

3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective :

Main objective of this subject is to introduce RISC Architecture in AVR Atmega32 Microcontroller and its features. To enable students design microcontroller based embedded systems for applications.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	100
3	0	0	3	60	40	0	0	

Details of Assessment Instruments under CE Theory Component :

Internal Exams **[30 Mark]**	Continuous Assessment **[10 Mark]**
Mid Sem 1 & Mid Sem 2 Exam	Quiz/Presentation/Simulations

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction to Microcontroller :** Overview of Digital circuits and microprocessor concepts, microprocessor and Microcontroller differences, Introduction to general Microcontroller architectures, RISC and CISC comparison, RISC features of AVR, Overview of AVR family and features.	3	10%
2	**AVR Architecture :** Atmega32 Microcontroller architecture, Registers, status register, Stack Memory, Data memory distribution, Flash memory and program counter, ATmega32 pins & function. Addressing modes of AVR, Editing and Assembling program, Assembler directives, Subroutine and Macros, Intel HEX file.	5	10%
3	**Digital IO Programming and applications :** C-programming and Data types, arithmetic and logical operations, delay generation, LED and switch programming, LCD programming; Matrix Keypad programming, 7-Segment Display, Ultrasonic Sensor, PIR Sensor, EEPROM programming, Timer/counter programming, Interrupts.	10	25%
4	**Analog IO Programming and applications :** Recall concepts of ADC and DAC, ADC Features, LM35 temperature sensor, LDR light sensor, DAC interfacing and programming.	10	20%
5	**Actuator Interfacing and Programming :** PWM concepts, DC motor control using PWM, Relay, Driver circuit, Opto-isolator, Reed Switch, Stepper Motor.	10	20%
6	**Communication Protocols :** Serial Port programming, GSM Modem, Bluetooth, SPI protocol, I2C Protocol and RTC interfacing.	7	15%
	Total	45	100%

List of References :

1. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, "The AVR Microcontroller and Embedded Systems: Using Assembly and C", 1st Edition, Pearson Education, 2012.
2. Dhananjay Gadre. "Programming and Customizing the AVR Microcontroller", 1st Edition, TMH, 2001.
3. AVR ATmega32 data sheet.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
15%	20%	25%	10%	10%	20%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs) :
At the end of this course students will be able to …
1. Relate concepts of Digital circuits and microprocessor with microcontroller and outline AVR features.
2. Understand AVR architecture and concepts assembly programming.
3. Interface and program digital IO devices to use it for user interface.
4. Make use of sensors for monitoring different quantities in application.
5. Design and use driving circuit to interface actuators in applications
6. Integrate Communication protocols for intra and inter system communication.

Course Articulation Matrix:
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated.*
The last row entry is the average of all COs for that PO/PSO. It shows the overall correlation of this course to each of the POs / PSOs.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 13	PSO14	PSO15
3EC02.1	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC02.2	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC02.3	3	3	3	3	3	2	3	1	1	1	1	2	3	2	3
3EC02.4	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC02.5	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC02.6	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC02	3	3	3	3	2.67	2.5	2.67	1	1	1	1	2	3	1.67	3

Delivery Methods :
Note: *List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc...*
1. *Presentations ppts*
2. *Simulations and videos*
3. *Hardware implementation*
4. *Discussions*

5. *Expert sessions*

Constituent COs in Assessment Tools :

Note: *Each of the COs must be addressed by at least one of the assessment instruments (e.g., tests, assignments, project, reports, etc...). Here, we need to justify this requirement by stating the distribution (in indicative or approximate percentages) of different COs in each of the assessment instruments.*

Sr. No	Course Outcomes	Assesment tools
1.	3EC02.1	**Exam, Assignments, Presentation, Experiments, Project etc**
2.	3EC02.2	**Exam, Assignments, Presentation, Experiments, Project etc**
3.	3EC02.3	**Exam, Assignments, Presentation, Experiments, Project etc**
4.	3EC02.4	**Exam, Assignments, Presentation, Experiments, Project etc**
5.	3EC02.5	**Exam, Assignments, Presentation, Experiments, Project etc**
6.	3EC02.6	**Exam, Assignments, Presentation, Experiments, Project etc**

3EC03 : Microcontroller and Applications Lab

CREDITS – 1 (L=0, T=0, P=2)

3rd **Year, B. Tech. (*Electronics & Communication*)**

Course Objective :

Main objective of this subject is to introduce RISC Architecture in AVR Atmega32 Microcontroller and its features. To enable students design microcontroller based embedded systems for applications.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	*0*	*2*	*1*	*0*	*0*	*40*	*60*	*100*

Details of Assessment Instruments under CE Practical Component: (60 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

- 60-mark distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Project/OEP	Total
10	10	10	30	60

Practical List :

Sr. No.	Practical List
1.	Demonstrate use of instructions and effect on Status Register. a. Data Transfer instruction
2.	Demonstrate use of Branching, arithmetic and logical instructions. Check effect on Status registers
3.	Conversion: BCD-ASCII, ASCII-BCD, HEX-BCD, BCD-HEX
4.	Basic Digital IO Programming : a. LED interfacing and programming b. Switch interfacing and programming. (with and without interrupt)
5.	Display interfacing and programming : a. LCD interfacing and programming b. 7-segment interfacing and programming
6.	Keypad interfacing and programming
7.	PIR sensor based motion detection
8.	Ultrasonic sensor based distance measurement.
9.	Temperature monitoring and control using LM35.
10.	Light intensity monitoring using LDR.
11.	DC motor direction control using L293D
12.	Stepper motor interfacing and programming.
13.	Serial communication programming.
14.	I2C – nRF24L01+ interfacing and programming.
15.	SPI – DS1307 interfacing and programming.

List of References :

1. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, "*The AVR Microcontroller and Embedded Systems: Using Assembly and C*", 1st Edition, Pearson Education, 2012.

2. Dhananjay Gadre. "*Programming and Customizing the AVR Microcontroller*", 1st Edition, TMH, 2001.
3. AVR ATmega32 data sheet.

Course Outcomes (COs) :

*(**Note:** Number of COs should be about 6. Each statement should start with an action verb. Attached herewith (in Annex-1) are example action verbs that can be used to address different levels of Bloom's taxonomy. You should prefer 3rd or higher level action verbs from this list.)*

At the end of this course students will be able to …

1. Relate concepts of Digital circuits and microprocessor with microcontroller and outline AVR features.
2. Understand AVR architecture and assembly programming.
3. Interface and program IO devices to use it for user interface.
4. Make use of sensors for monitoring different quantities in application.
5. Design and use driving circuit to interface actuators in applications
6. Integrate Communication protocols for intra and inter system communication.

Course Articulation Matrix :

***Note:** Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
***1:** Slight (Low) **2:** Moderate (Medium) **3:** Substantial (High) **'-':** Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO 14	PSO 15
3EC03.1	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC03.2	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC03.3	3	3	3	3	3	2	3	1	1	1	1	2	3	2	3
3EC03.4	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC03.5	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC03.6	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC03	3	3	3	3	2.67	2.5	2.67	1	1	1	1	2	3	1.67	3

Delivery Methods :

***Note:** List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc.*

1. *Atmel Studio IDE for Atmega32 programming*
2. *Proteus Simulations*
3. *Hardware interfacing – Sensors and Actuators with kit*

Constituent COs in Assessment Tools :

***Note:** Each of the COs must be addressed by at least one of the assessment instruments (e.g., tests, assignments, project, reports, etc...).Here, we need to justify this requirement by stating the distribution (in indicative or approximate percentages) of different COs in each of the assessment instruments.*

Sr. No	Course Outcomes	Assesment tools
1.	3EC03.1	**Exam, Assignments, Presentation, Experiments, Project etc**
2.	3EC03.2	**Exam, Assignments, Presentation, Experiments, Project etc**
3.	3EC03.3	**Exam, Assignments, Presentation, Experiments, Project etc**
4.	3EC03.4	**Exam, Assignments, Presentation, Experiments, Project etc**
5.	3EC03.5	**Exam, Assignments, Presentation, Experiments, Project etc**
6.	3EC03.6	**Exam, Assignments, Presentation, Experiments, Project etc**

3EC04: CMOS Digital Integrated Circuits
CREDITS – 3 (L=3, T=0, P=0)

3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective :

The course intends to provide an understanding of the building blocks for microprocessor/microcontroller or digital VLSI circuit based on the MOS circuit. The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved in CMOS design.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	0	0	100

Details of Assessment Instruments under CE Theory Component :

Internal Exams **[30 Mark]**	Continuous Assessment **[10 Mark]**
Mid Sem 1 & Mid Sem 2 Exam	**Quiz** based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction and Fabrication of MOSFET :** Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, Style for digital system design, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology. Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design.	8	15%
2	**MOS Transistor & FinFET :** The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current Voltage characteristics, MOSFET scaling and small geometry effects, MOSFET capacitances ,FinFET: model(BSIM-CMG),physics and operation.	8	20%
3	**MOS Inverters: Static characteristics:** Introduction, Resistive load Inverter, Inverter with n-type MOSFET load Enhancement and Depletion type MOSFET load, CMOS Inverter	6	15%
4	**MOS Inverters: Switching characteristics and Interconnect Effects :** Delay-time definitions, Calculation of Delay times, CMOS Ring oscillator Circuit, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.	8	15%
5	**Combinational-Sequential and Dynamic MOS Logic Circuits :** Introduction, MOS logic circuits with Depletion nMOS Loads, CMOS logic circuits, Complex logic circuits, CMOS Transmission Gates (TGs). Behavior of Bistable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop. Introduction, Basic Principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.	9	20%

Unit No.	Topics	Teaching Hours	Weightage
6	**Chip I/P, O/P Circuits, Design for testability and Introduction to FINFET:** On chip Clock Generation and Distribution, Latch –Up and its Prevention. Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self-Test (BIST) techniques, current monitoring IDDQ test.	6	15%
	Total	45	100%

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
20%	20%	15%	20%	15%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

List of References :

1. Sung – Mo Kang, Yusuf Leblebici, "*CMOS Digital Integrated circuits – Analysis and Design*", 3 edition, Mc Graw Hill Education, 2002
2. Adel S. Sedra, Kenneth C. Smith, "*Microelectronic Circuits*", Sixth Edition, Oxford University, 2013.
3. Douglas A. Pucknell and Kamran Eshraghian, "*Basic VLSI Design*", 3rd edition, PHI Learning, 2009.
4. John P. Uyemura , "*Introduction to VLSI Circuits & Sys*tems" 1st edition, Wiley, 2001
5. Yogesh Chauhan, Darsen Duane Lu, Vanugopalan Sriramkumar, Sourabh Khandelwal Juan Duarte ,Navid Payvadosi, Ai Niknejad, Chenming Hu "*FinFET Modeling for IC Simulation and Design*", 1st edition, BSIM-CMG Standard, February 2015.

Course Outcomes (COs) :

At the end of this course students will be able to …

1. Understand the fabrication process of IC technology and VLSI design flow.
2. Analyze the electrical and physical properties of MOSFET.
3. Have an understanding of the static and switching characteristics of MOSFET based circuit.
4. Analyze, understand the design of Combinational, Sequential and dynamic Logic circuits.
5. Develop the understanding of CMOS latch-up, clocking strategy, and testing principles.
6. Develop the CMOS based digital circuits to solve the real-life problem.

Course Articulation Matrix:

Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 13	PSO 14	PSO 15
3EC04.1	2	2	2	2	2	2	1	1	1	1	2	1	2	2	1
3EC04.2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	1
3EC04.3	2	2	2	2	2	2	1	1	1	1	1	2	3	2	2
3EC04.4	3	2	2	3	2	2	1	1	1	1	1	2	3	1	2
3EC04.5	3	3	2	3	2	2	1	1	1	1	1	1	3	1	2
3EC04.6	3	3	3	3	3	1	1	1	3	1	2	3	2	2	2
Avg.	2.5	2.3	2.2	2.5	2.2	1.8	1.0	1.0	1.3	1.0	1.3	1.8	2.5	1.7	1.7

Delivery Methods :

Note: *List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc...*

Lectures & Laboratory :

- *Through blackboard, discussions, expert session, power-point slides, simulation, videos, animations, pictures, graphics etc.*
- *Performance of Experiments Using MICROWIND Software*

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	3EC04.1	Exam, Assignments, Presentation, Experiments, Project etc
2.	3EC04.2	Exam, Assignments, Presentation, Experiments, Project etc
3.	3EC04.3	Exam, Assignments, Presentation, Experiments, Project etc
4.	3EC04.4	Exam, Assignments, Presentation, Experiments, Project etc
5.	3EC04.5	Exam, Assignments, Presentation, Experiments, Project etc
6.	3EC04.6	Exam, Assignments, Presentation, Experiments, Project etc

3EC05 : CMOS Digital Integrated Circuits Laboratory
CREDITS – 1 (L=0, T=0, P=2)
3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective :

The course intends to provide an understanding of the building blocks for microprocessor/microcontroller or digital VLSI circuit based on the MOS circuit. The main

focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved in CMOS design.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

- 60-mark distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Quiz	ALA	Total
10	10	10	15	15	60

Sr. No	Name of Practicals
1.	Introduction to layout design software - Microwind.
2.	To Study MOSIS (MOS Implementation System) layout Design Rules.
3.	To Study and implement n-MOS / pMOS transistor and its V-I characteristic using Microwind.
4.	To Study and implement CMOS Inverter using Microwind.
5.	To Study and implement NAND, AND gate using Microwind.
6.	To Study and implement NOR, OR gate using Microwind.
7.	To Study and implement XNOR, XOR gate using Microwind.
8.	Introduction to DSCH Software and Verilog.
9.	To Study and implement 2:1 MUX CMOS layout using DSCH and Verilog .

10.	To Study and implement Half-Adder CMOS layout using DSCH and Verilog .
11.	To Study and implement CMOS Ring Oscillator CMOS layout using DSCH and Verilog .
12.	To Study and implement Full Adder CMOS layout using DSCH and Verilog.
13.	To Study and implement Two bit Comparator CMOS layout using DSCH and Verilog.
14.	To Study and implement Edge Triggered D-Flip Flop CMOS layout using DSCH and Verilog.
15.	Mini Project – Presentation.

List of References:
Note: *List books, web resources etc ... A book should be referred in following format:*
List of Author(s), "Title of the Book", Edition number, Publisher's name, Year of Publication

1. Etienne Sicard. *Microwind & Dsch User's Manual Lite Version*, 2009
2. Kang, Sung-Mo, and Yusuf Leblebici, "*CMOS digital integrated circuits*", Tata McGraw-Hill Education, 2003.
3. R.J Backer, H. W. Li, D. E. Boyce ,"*CMOS design, layout and simulation*", IEEE Press, 1998

Course Outcomes (COs) :
*(**Note:** Number of COs should be about 6. Each statement should start with an action verb. Attached herewith (in Annex-1) are example action verbs that can be used to address different levels of Bloom's taxonomy. You should prefer 3rd or higher level action verbs from this list.)*

At the end of this course students will be able to ...
1. Understand the fabrication process of IC technology and VLSI design flow.
2. Analyze the electrical and physical properties of MOSFET.
3. Have an understanding of the static and switching characteristics of MOSFET based circuit.
4. Analyze, understand the design of Combinational, Sequential and dynamic Logic circuits.
5. Develop the understanding of CMOS latch-up, clocking strategy, and testing principles.
6. Develop the CMOS based digital circuits to solve the real-life problem.

Course Articulation Matrix:
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)**2:** Moderate (Medium)**3:** Substantial (High)* ***'-':*** *Not correlated. The last row entry is the average of all COs for that PO/PSO. It shows the overall correlation of this course to each of the POs / PSOs.*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 13	PSO 14	PSO 15
3EC04.1	2	2	2	2	2	2	1	1	1	1	2	1	2	2	1
3EC04.2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	1
3EC04.3	2	2	2	2	2	2	1	1	1	1	1	2	3	2	2
3EC04.4	3	2	2	3	2	2	1	1	1	1	1	2	3	1	2
3EC04.5	3	3	2	3	2	2	1	1	1	1	1	1	3	1	2
3EC04.6	3	3	3	3	3	1	1	1	3	1	2	3	2	2	2
Avg.	2.5	2.3	2.2	2.5	2.2	1.8	1.0	1.0	1.3	1.0	1.3	1.8	2.5	1.7	1.7

Delivery Methods:

Note: *List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc...*

Lectures & Laboratory :

- Through blackboard, discussions, expert session, power-point slides, simulation, videos, animations, pictures, graphics etc.
- Performance of Experiments Using MICROWIND Software

Constituent COs in Assessment Tools:

Note: *Each of the COs must be addressed by at least one of the assessment instruments (e.g., tests, assignments, project, reports, etc...). Here, we need to justify this requirement by stating the distribution (in indicative or approximate percentages) of different COs in each of the assessment instruments.*

Sr. No	Course Outcomes	Assesment tools
1.	*3EC04.1*	Exam, Assignments, Presentation, Experiments, Project etc
2.	*3EC04.2*	Exam, Assignments, Presentation, Experiments, Project etc
3.	*3EC04.3*	Exam, Assignments, Presentation, Experiments, Project etc
4.	*3EC04.4*	Exam, Assignments, Presentation, Experiments, Project etc
5.	*3EC04.5*	Exam, Assignments, Presentation, Experiments, Project etc
6.	*3EC04.6*	Exam, Assignments, Presentation, Experiments, Project etc

Note : *Different abbreviations used above (as per NBA / Academic Regulations of BVM): CO = Course Outcome, PO = Program Outcome, PSO = Program Specific Outcome, ESE = End Semester Evaluation, CE = Continuous Evaluation, The subscripts* ***tm*** *and* ***pm*** *used with 'ESE' and 'CE' indicate the respective* ***t****heory and* ***p****ractical*

3EC41: POWER ELECTRONICS

CREDITS - 4 (L=3, T=0, P = 2)

3rd Year, B.Tech (Electronics & Communication)

Course Objective:

This course provides strong foundation for understanding and designing of domestic and industrial power electronics devices and circuits.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component:

Mid Semester Exam [20]	Presentation/Quiz/ [10]	Attendance/ OEP [10]
Theory mid semester exams	Presentations/ Quiz	Lecture attendance/OEP

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction of Power Semiconductor Devices and Controlled Circuits :** Construction and Characteristics of Power diodes, Power Transistors, SCR, DIAC, TRIAC, UJT, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs), Gate turn-off Thyristors (GTOs), Integrated Gate-Commutated Thyristors (IGCTs), MOS controlled Thyristors (MCTs), two transistor model of SCR, static and dynamic characteristics, gate characteristic, turn-on methods of a thyristor, turn-off methods of a thyristor , Isolation of gate and base drive using pulse transformer and Opto-couplers, gate triggering circuits, series & parallel connection of thyristors, di/dt & dv/dt protection, Power Integrated circuits (PICs), Intelligent Power Modules, Solid State Relay(SSR), Power Contactor	13	30
2	**AC to DC Converter :** Review of half-wave and full-wave diode rectifier ; Single phase, half wave, Full wave, half controlled bridge and Full controlled bridge converter with resistive and inductive loads. Effect of freewheeling diodes. Three phase controlled converter.	06	13

Unit No.	Topics	Teaching Hours	Weightage %
3	**DC to DC Converter :** The chopper, Principle of chopper operation, classification of choppers, Step-Up, Step-down and Step-Up/Down chopper, control strategies, Chopper configuration, Voltage and current commutated chopper, Load Commutated Chopper, multiphase chopper.	06	13
4	**DC to AC Converter :** Thyristor inverter classification, Single phase half and full bridge voltage source inverters, performance parameters of inverters, Internal control of inverter, Pulse Width Modulated inveters, current source inverters	06	13
5	**AC to AC Converter :** Cycloconverter: Basic principle of operation. Single phase to single phase, Three phase to single phase Cycloconverter. AC regulators: Single phase half wave A.C. voltage regulators, Single phase full wave (bidirectional) A.C. voltage regulators with resistive load and resistive-inductive load.	06	13
6	**Power Electronics Applications :** AC Drives, DC Drives, SMPS, Online and Off line UPS, Battery charger, Constant Voltage Transformer, Solar Inverter, Simulate power electronic converters and their control scheme using MATLAB.	08	18
	Total Hrs.	**45**	**100**

List of References :

1. M D Singh and K B Khanchandani, "*Power Electronics*" ,2nd Edition, TMH, 2008.
2. Muhammad Rashid, "*Power Electronics Circuits Devices and Application* ", 3rd Edition, Pearson Education, 2003
3. Elbs R. Ramshaw,"*Power Electronics Semiconductor Switches*", 2/E, Springer, 1993.
4. Ramamourthy, "*An Introduction to Thyristor and Their Applications*", 2nd edition, East West Books Pvt Ltd ,1991.

Course Outcomes (COs) :

At the end of this course students will be able to.....

1. Understand the construction and characteristics of power semiconductor devices.
2. Design and analyze various SCR firing and commutation methods.
3. Analyze, operate and design of various industrial based power electronics converters.
4. Apply the knowledge of power electronic converter for speed control of DC motors, AC motors and industrial applications.
5. Understand the SMPS, UPS, Battery charger, and simulation of power electronics converter .

Details of Assessment Instruments under CE Practical Component :

Term work [10]	**Assignment [10]**	**Attendance/ Mini Project [10]**
Lab File preparation and understanding	Assignments	Laboratory attendance/Mini project

List of Experiments :

Sr. No.	**Name of the Experiment**
1.	To study the V-I characteristics of DIAC.
2.	To study the V-I characteristics of SCR (silicon controlled rectifier).
3.	To study the characteristics of TRIAC.
4.	To study the V I characteristics of IGBT.
5.	To study commutation methods with appropriate circuits and waveforms.
6.	To study R firing circuit for SCR.
7.	To study UJT as a relaxation oscillator.
8.	A C voltage controller using TRIAC-DIAC combination
9.	Single phase HALF WAVE controlled converter with R, RL, RL + D " load.
10.	To Study the single phase centre tap full wave controlled converter R, RL, RL + D " load.
11.	Speed control of DC separately excited motor with phase controlled converter.

12.	To study about UPS (Uninterruptible Power Supply)
13.	To study basic chopper using MATLAB Simulink.
14.	To study basic inverter using MATLAB Simulink.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC41.1	3	1	2	2	2	-	-	1	1	1	1	1	1	1	1
3EC41.2	3	3	3	2	2	-	-	1	1	1	1	1	2	2	2
3EC41.3	3	2	2	2	2	-	-	1	1	1	1	1	2	2	2
3EC41.4	3	1	1	1	1	-	-	1	1	1	1	1	1	1	1
3EC41.5	3	3	3	2	1	-	-	1	1	1	1	1	1	1	1
Average	3	2	2.2	1.8	1.6	-	-	1	1	1	1	1	1.4	1.4	1.4

Delivery Methods :

1. Lectures: Using Black Board/ Power-point slides, videos.

2. Laboratory: Performance of Experiments Using Power Electronics kits and MATLAB Software for Simulink and to generate outputs, Function Generator, Oscilloscope, Multimeter, Power Supply etc.

Consumable Items :

Power Electronic kits, Various types of thyristors (SCRs, TRIAC. DIAC, IGBT), different ranges of transformers, pulse transformers, Bread Board, Function Generator, Oscilloscope, Multimeter, Power Supply, hook-up wires, Soldering iron, Desoldering pump, Electronics Toolkit etc

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	3EC41.1	Exam, Assignments, Presentation, Experiments
2.	3EC41.2	Exam, Assignments, Presentation, Experiments
3.	3EC41.3	Exam, Assignments, Presentation, Experiments
4.	3EC41.4	Exam, Presentation, Experiments
5.	3EC41.5	Exam, Presentation, Experiments

***Note:** Different abbreviations used above (as per NBA / Academic Regulations of BVM):*

*CO = Course Outcome, PO = Program Outcome, PSO = Program Specific Outcome, ESE = End Semester Evaluation, CE = Continuous Evaluation, The subscripts **tm** and **pm** used with 'ESE' and 'CE' indicate the respective **t**heory and **p**ractical*

Distribution of marks for theory examinations (in %) :

Bloom's Taxonomy Level	R Level	U Level	A Level	N Level	E Level	C Level
Distribution (in %)	15	30	15	25	10	05

Above % distribution may have subjected to vary likely.

3EC42 : Digital Systems design using HDL
CREDITS – 3 (L=3, T=0, P=2)
3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective :

This course intends to provide the strong foundation of the design of digital systems using a hardware description language, HDL. The students will have design practice sessions and implementing digital logic systems with electronic design tools.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Details of Assessment Instruments under CE Theory Component :

Internal Exams **[30 Mark]**	Continuous Assessment **[10 Mark]**
Mid Sem 1 & Mid Sem 2 Exam	**Quiz** based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction :** History, About HDL, VLSI Design Flow, EDA Tools, Fundamental HDL Units, VLSI design Styles, Programmable Logic Devices, Standard Cell, Full-Custom Design, Basic details of Verilog, Comparision of Verilog and VHDL	8	15%
2	**Basic Language constructs and Conventions - I :** Fundamental HDL Units, Data Types, Objects, Array, Overloading, Type Conversion, Legal versus Illegal Assignments, Operators and Attributes, Concurrent versus Sequential, Signals and Variables, Conditional – Loop – Case Statements, Examples	8	20%
3	**Basic Language constructs and conventions-II :** Introduction, package, component, port map , generic map , function, procedure, function versus procedure, assert - examples	6	15%
4	**HDL design of State Machines and Memory circuits:** Template for FSMs, Poor FSM Model, FSM Encoding Styles, The State-Bypass Problem in FSMs, Systematic Design Technique for Timed Machines,FSMs with Repetitive States, Bidirectional Buses,ROM Design,RAM Design,External Memory Interfaces, ALU -Examples.	8	15%
5	**HDL design of the basic display and Serial Communications Circuits:** Basic LED-SSD-LCD Driver, Seven-Segment Display, Frequency Meter, Digital Clock, Data Serializers/Deserializers, PS2 Interface, I2C Interface, SPI Interface	9	20%
6	**Test bench and Verification:** Introduction of Test bench and Verification Methods, Introduction to UVM, Introduction to basics of DFT	6	15%
	Total	45	100%

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
20%	15%	20%	10%	15%	20%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

List of References:
Note: *List books, web resources etc ... A book should be referred in following format:*
List of Author(s), "Title of the Book", Edition number, Publisher's name, Year of Publication

1. Pedroni, Volnei A., "*Circuit Design and Simulation with VHDL*", 2nd Edition, MIT Press, MIT press, 2004.
2. Samir Palnitkar, *"Verilog HDL"*, Pearson Education, Second Edition,2009.
3. Bhasker J., *"VHDL Primer"*, Englewood Cliffs, NJ: Prentice Hall, 3rd Edition, 1999.
4. P. J. Ashenden, *"The Designer's Guide to VHDL"*, Elsevier Science, 2010.
5. Perry D. L., *"VHDL Programming By Example"*, New York: McGraw-Hill, 2nd Edition, 1994.

Course Outcomes (COs):
At the end of this course students will be able to ...

1. Understand the VLSI design flow and use of HDL for digital systems design.
2. Target an HDL design to an FPGA board.
3. Discriminate between combinatorial and sequential digital circuits.
4. Analyze, understand the design of State Machine based digital applications.
5. Develop a digital logic and apply it to solve real-life problems.
6. Develop the skill to understand the importance of test bench and verification methods.

Course Articulation Matrix :
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC42.1	2	1	1	2	1	2	2	1	1	1	2	1	2	2	2
3EC42.2	2	2	2	2	2	2	1	1	2	1	1	2	2	2	2
3EC42.3	2	2	2	2	2	2	1	1	2	1	1	2	2	2	2
3EC42.4	3	3	3	3	2	2	1	1	2	1	1	2	2	2	2
3EC42.5	2	3	3	3	3	2	1	1	3	2	2	2	2	2	2
3EC42.6	2	2	1	1	1	2	1	1	1	2	2	1	2	2	2
Avg.	2.2	2.2	2.0	2.2	1.8	2.0	1.2	1.0	1.8	1.3	1.5	1.7	2.0	2.0	2.0

Delivery Methods:

Note: *List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc...*

Lectures & Laboratory :

- Through blackboard, discussions, expert session, power-point slides, simulation, videos, animations, pictures, graphics etc.
- Performance of Experiments Using Spartan 3A/3AN Trainer Board and Xilinx ISE Design Suite

Constituent COs in Assessment Tools:

Note: *Each of the COs must be addressed by at least one of the assessment instruments (e.g., tests, assignments, project, reports, etc...). Here, we need to justify this requirement by stating the distribution (in indicative or approximate percentages) of different COs in each of the assessment instruments.*

Sr. No	Course Outcomes	Assesment tools
1.	3EC42.1	Exam, Assignments, Presentation, Experiments, Project etc
2.	3EC42.2	Exam, Assignments, Presentation, Experiments, Project etc
3.	3EC42.3	Exam, Assignments, Presentation, Experiments, Project etc
4.	3EC42.4	Exam, Assignments, Presentation, Experiments, Project etc
5.	3EC42.5	Exam, Assignments, Presentation, Experiments, Project etc
6.	3EC42.6	Exam, Assignments, Presentation, Experiments, Project etc

Note : *Different abbreviations used above (as per NBA / Academic Regulations of BVM): CO = Course Outcome, PO = Program Outcome, PSO = Program Specific Outcome, ESE = End Semester Evaluation, CE = Continuous Evaluation, The subscripts **tm** and **pm** used with 'ESE' and 'CE' indicate the respective **t**heory and **p**ractical*

Details of Assessment Instruments under CE Practical Component : (30 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

- 30-mark distribution (Internal Continuous Evaluation)

File	Attendance	ALA/Presentation	Total
10	10	10	30

Practical List :

Sr. No	List of Experiments
1.	Introduction to Xilinx ISE / Intel Quartus Prime Design Software's use for programming, simulation and synthesis using all logic gates.
2.	Write a HDL code to describe the functions of a Full adder using all modeling styles.
3.	Write a HDL code for the following combinational designs ; (a) 2 to 4 decoder (b) 8 to 3 encoder (without priority & with priority) (c) 8 to 1 multiplexer (d) 4 bit binary to gray converter (e) Demux and Comparator
4.	HDL Code for the following flip-flops: SR, D, JK, and T
5.	Write a HDL code to implement ROM.
6.	Write a HDL code to Blink an LED on FPGA/CPLD board.
7.	Write a HDL code for 4-bit binary , BCD counters (Synchronous reset and asynchronous reset) and "any sequence" counters
8.	Write a HDL code to design Traffic light controller (TLC) with regular, test and standby mode of operation.
9.	Write a HDL code to display a alphanumeric on the given LED segment.
10.	Write a HDL code to display a alphanumeric on the given LCD segment.
11.	Write a HDL code to design PS2 Interface driver.
12.	Write a HDL code to design I2C Interface driver.
13.	Write a HDL code to design SPI Interface driver.
14.	Mini Project based on VHDL/Verilog Programming.

3EC43 : Industrial Automation

CREDITS - 4 (L=3, T=0, P=2)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective :

Know general PLC issues, to be able to write simple ladder logic programs, understand the operation of a PLC, Programming of PLCs, and Working with SCADA software, Implementation of Distributed Control Scheme.

Teaching and Assessment Scheme :

Teaching Scheme	Credits	Assessment Scheme

L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component : (40 marks)

Mid Semester Exams	Quiz	Total
30	10	40

Details of Assessment Instruments under CE Practical Component : (30 marks)

Open Ended Problems	Attendance/Assignments	Total
15	15	30

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage (%)
1	**Introduction to Automation :** Introduction to Automation, Requirement of Automation, Role of Automation, History of Automation, Architecture of Industrial automation system, Industrial Automation vs. Industrial Information Technology	4	09%
2.	**Automation components :** Relays, Switches and its types, Sensors (Liquid and Gases sensor, Motion, level, PH, Humidity measurement sensor), Control Actuators (Solenoids, valve, Hydraulics, Pneumatics),	08	18%

Unit No.	Topics	Teaching Hours	Weightage (%)
3.	**Programmable logic controller:** Introduction, Advantages of PLC base control system, Architecture of PLC, Working principle of PLC, Types of I/O and Memory, Timers, counters and registers, PLC Scan cycle, Maintenance and trouble shooting of PLC, Selection of PLC.	09	20%
4.	**Instruction set, PLC programming and various design methods:** Data transfer instructions, Arithmetic and Logical instructions, Compare instructions, Timer and counter instructions, Ladder network programming for industry based Applications (Object counter, On-off control, Car parking, Sequential starting of motors, Traffic light control, Motor in forward and reverse direction, Filling of bottles, Room Automation), Other programming methods(Instruction List, Structured Text, Functional Block Diagram, Sequential Function Chart)	10	22%
5.	**Introduction to HMI, DCS and SCADA :** Introduction and architecture of HMI, Overview of DCS, Features of DCS, Advantages of DCS, Introduction to SCADA.Creating new SCADA Project, Introduction to graphic Properties like Sizing, Blinking, Filling, Analog Entry, Movement of Objects, Visibility etc, Application of scripts in SCADA, Communication between SCADA and PLC.	10	22%
6.	**Communication protocol for PLC, SCADA and HMI** Different types of SCADA protocol, Safety, Security and precautions while dealing with industry project, Current trends in Industry Automation and Industry 4.0.	04	09%
	Total	45	100

List of References :

1. S.K. Singh, "*Industrial Instrumentation and Control*", McGraw Hill Companies, 3rd Edition, 1980.
2. C.D. Johnson, "*Process Control Instrumentation Technology*", PHI, 8th Edition, 2006
3. W. Bolton, "*Programmable Logic Controllers*" ,Newness publications, 4th Edition,2003

4. John W. Webb, Ronald A. Reis, "*Programmable logic controllers, Principles and Applications*", PHI, 5th Edition, 2003.

Course Outcomes (COs) :

By learning this course students will be able to …
1. Understand basics of Industrial Automation system and its requirement
2. Acquire knowledge of various automation components and systems.
3. Analyze architecture and working of PLC.
4. Develop skills for Programming PLC and use it for industrial automation
5. Integrate SCADA with PLC and understand basics of HMI and DCS.

Course Articulation Matrix :
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC43.1	3	3	3	3	2	2	-	-	-	-	1	1	3	2	1
3EC43.2	3	3	3	3	1	1	-	-	-	-	1	1	3	2	1
3EC43.3	3	3	3	3	2	1	-	-	-	-	1	1	3	2	1
3EC43.4	3	3	3	3	2	3	-	1	2	1	1	1	3	2	1
3EC43.5	3	3	3	3	2	2	-	-	-	-	1	1	3	2	2
AVG.	3	3	3	3	1.8	1.8	-	0.2	0.4	0.2	1	1	3	2	1.2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures
2. Hands on session with PLC kits and software

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	10	15	15

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers.
The actual distribution of marks in the question paper may vary slightly from above table

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	3EC43.1	**Exam, Assignments, Presentation etc**
2.	3EC43.2	**Exam, Assignments, Quiz etc**
3.	3EC43.3	**Exam, Assignments, Presentation etc**
4.	3EC43.4	**Exam, Assignments, Industrial visit etc**
5.	3EC43.5	**Exam, Assignments, Industrial visit, Group discussion etc**

List of Experiments :

Sr.No.	Practical List
Set-1	Design a ladder logic using given ladder structure.
1.	The input switches are x0, x1, x2. Output lamps are y1, y2, y3. If anyone switches press then only lamp-1 comes on. If any two switches press then only lamp-2 comes on. If any three switches press then only lamp-3 comes on.
2.	Code ladder logic such that when X0 is pressed, Y0 gets latched. When X1 is pressed, nothing should happen, but when X1 is released, Y0 should unlatch.
3.	Consider X0 and X1 are the start switches. X2 is the stop switch. Y0 and Y1 are the outputs. Code a ladder logic 1. When both the input switches are on then, Y0 and Y1 should be ON. 2. When both the input switches are on then, Y0 and Y1 should be OFF. 3. When we press the stop switch irrespective of start switches then none of the outputs get on.
Set-2	Ladder logic for digital circuits.
1.	Design ladder logic for all logic gates.
2.	Design ladder logic for half adder and full adder.
3.	Perform a BCD addition using ladder logic.
4.	Design 4x1 multiplexer and d-multiplexer using ladder logic.
5.	Design ladder logic for BCD to Exxcess-3 code converter.
6.	Design J–k flip flop using ladder logic.
Set-3	Perform arithmetic operation.
1.	Design ladder logic to find average of 10 numbers.
2.	Design ladder logic to find accurate pipe flow. The diameter of pipe is 10mm and flow rate is 25mm/s. Flow=Cross section area x flow rate.

3.	Design a ladder logic to implement the given floating point operation. [(1.236 + 1.325) x 2.3] / 10.24
Set-4	Application of timer and counter.
1.	Code a logic that can be used to 1. Start a motor1 (Y1) using X0(NO) and then after a delay of 10 second, start motor2 (Y2). 2. When motor1 (Y1) is switched off using X1(NC), there should be delay of 10 second before the motor2 (Y2) is off.
2.	Code a logic in which Y0 is ON only when X1(NO) is ON in 10 second just after the start of the switch X0. Otherwise if X1 is pressed after 10 second, nothing should happen.
3.	Traffic signal controlling: When start button press(X0) then the red light (Y0) ON for 30 second. After 30 second, the red light gets off and yellow light (Y1) gets ON for 25 seconds. After 25 seconds, the yellow light gets off and green light (Y2) gets ON for 35 seconds. After 35 seconds, Green light gets off and process gets repeat.
4.	Code logic to blink the output Y0 using X0. Use mov command to change the delay time. Default blinking time (ON time=1sec and OFF time=1sec) 1. When X1 is pressed, blinking time gets change.(ON time=2sec and OFF time = 1sec) 2. When X2 is pressed, blinking time gets change.(ON time=3sec and OFF time = 2sec)
5.	Design logic to generate a square wave of 4Khz.
6.	Code logic, when X0 is pressed 3 times, Y0 and Y1 gets ON at the same time.
7.	Code a logic in which When X1 is pressed once, Y0 gets ON and Y1 & Y2 get OFF. When X1 is pressed twice, Y1 gets ON and Y0 & Y2 get OFF. When X1 is pressed thrice, Y2 gets ON and Y0 & Y1 get OFF. When X1 is pressed fourth time, all outputs should be OFF and cycle should repeat again on pressing X1 again.
8.	Design a digital clock using 3 counters together with the flag of M1013 (1 second clock pulse) to operate a 24-hour clock. C0 – Count per second C1 – Count per minute C2 – Count per hour M1013 – 1sec clock pulse.
9.	Classroom capacity measurement: A classroom has a capacity of maximum 120 students. There are two doors, one for entry and the other for exit. When number of students in classroom is less than 120, entry door has a green light in on it, which remains ON. When number of students in the class room is 120, Red light goes ON and turning OFF the green light which indicates that the classroom has reached its maximum capacity and is full.
Set-5	Application of automation for controlling the industrial process.

1.	Two tanks are connected with each other through a pipeline in series. Level of both tanks is to be controlled. Implement this operation in PLC using Ladder Diagram programming language.
2.	Automatic Liquids Mixing Control System
3.	Automatic Door Control
4.	Automatic Coffee Maker
5.	Reservoir Level Control
6.	Count and Pack Parts from Conveyer:
7.	Automatic car wash process:
Set-6	FBD (Functional Block Diagram) Programming for PLC.
1.	Controlling of two outputs using one input.
2.	Introduction of Analog signal controlling.
3.	Compare the two analog signals. If the difference is more than 5 than the output should be ON and if the difference is less than 3 than output should be off.
4.	Light and Fan controlling using ON-OFF delay. When input switch is ON, Light should be ON immediately and Fan should be ON after 10 seconds. When input switch is OFF, Light should be OFF immediately and Fan should be OFF after 7 seconds.
5.	Automatic door control. (As given in the problem statement 3 from sec. 4)
Set-7	Introduction to SCADA.
1.	Controlling of lights using slider.
2.	Controlling the flow liquid and appropriate path to flow the liquid in the tanks.

Open ended Problems :

1. Develop graphical user interface for the plant visited by you
2. Design of low cost PLC Systems
3. Industrial visit report with detailed observation and find scope of improvement in existing system with possible solutions.

3EC81: Introduction to Cellular Communication

CREDITS - 4 (L= 3 , T = *0* , P = 2)

***3rd* Year (OE I), B. Tech. (*Electronics and Communication*)**

Course Objective :

To understand the concept of mobile communication, frequency reuse, wireless model, GSM & CDMA network, various wireless protocols & its applications related to mobile communication.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment/Instruments under CE Practical Component :

Term work [20]	**Quiz [10]**
Attendance/Lab File /ALA	Experiment Performance/Questions & Answers

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage (%)
1.	**Evolution of Mobile Communication Systems :** Introduction-base station, mobile station, MSC, forward and reverse channel, control channel, Paging system, Cordless telephone system, Cellular telephone system, Advantages and disadvantages of mobile communications, Comparison of wireless systems, applications of wireless communications.	04	12
2.	**Cellular Concept – System Design Fundamentals :** Introduction, frequency reuse, channel assignment strategies, handoff strategies, umbrella cell concept, interference and system capacity, co-channel and adjacent channel interference, cell splitting, sectoring, microcell zone concept.	06	16
3.	**Mobile Communication Engineering :** Introduction, Radio paths, Propagation attenuation, Basic propagation mechanisms, mobile radio channel, simulation of wireless fading channels, free space propagation model, outdoor propagation model.	08	18

Unit No.	Topics	Teaching Hours	Weightage (%)
4.	**GSM & CDMA Systems :** GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, CDMA architecture.	12	20
5.	**3G and 4G Digital Mobile Technology :** 2.5G TDMA evolution path, GPRS technology, EDGE technology, 2.5G CDMA technology, Need of 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, W-CDMA air interface, TD-SCDMA technology, CDMA 2000 technology. 4G-LTE.	09	18
6.	**Emerging Wireless Network Technologies :** IEEE 802.11 WLAN technology, IEEE 802.15 WPAN technology, IEEE 802.16 WMAN technology, Mobile adhoc networks (MANETs), Wireless sensor networks, RFID technology, IEEE 802.21 standards overview, Case studies of latest wireless technologies.	06	16
	Total	45	100

Suggested specification table with marks (Theory)

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	20	15	20	15	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References :

1. T. L. Singal, *"Wireless Communications"*, Tata McGraw Hill Education Private Limited, 2nd Edition, 2011.
2. T. S. Rappaport, *"Wireless Communications: Principles and practice"*, Pearson, 2nd

Edition, 2010.
3. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
4. Razavi, "*RF Microelectronics*", Prentice Hall, 1st Edition, 1998.
5. W.C.Y. Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecomm., 2nd Edition, 1998.

Course Outcomes (COs) :

By learning this course student will be able to …

1. Understand the basics of mobile communication systems.
2. Design the cellular system and improve the coverage and capacity of system.
3. Analyze and design the various mobile propagation model.
4. Design GSM and CDMA wireless networks.
5. Study the 3G and 4G digital mobile technology.
6. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC81.1	2	2	2	1	2	2	-	-	1	1	2	3	2	2	2
3EC81.2	3	3	3	2	2	2	2	1	-	2	2	3	2	2	2
3EC81.3	3	3	2	2	2	2	1	-	1	2	2	3	1	2	1
3EC81.4	3	3	2	2	2	2	1	1	1	2	2	3	2	2	2
3EC81.5	3	3	2	2	2	2	-	1	1	3	2	3	2	2	2
3EC81.6	2	2	2	2	2	2	1	1	1	3	2	3	2	2	3
Average	2.67	2.67	2.17	1.83	2	2	0.83	0.67	0.83	2.17	2	3	1.83	2	2

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Part I: Using MATLAB Software various simulations are performed like Rayleigh and Ricean distribution function, various mobile radio propagation model, BER of various modulation technology etc.
3. Laboratory: Part II: Performance of experiments using GSM and CDMA Trainer kits.

List of Experiments:

At least ten experiments based on available software and hardware.

Sr. No.	Aim

1	Introduction to MATLAB related to Mobile Communication.
2	To study and understand random data generation and calculating Bit Error Rate (BER) in it.
3	Write a MATLAB program to plot reflection coefficient v/s angle of incident for parallel electric field component.
4	Write a MATLAB program to plot reflection coefficient v/s angle of incident for perpendicular electric field component.
5	Write a MATLAB program to find median path loss using Okumura model and also plot the median path loss v/s frequency graph.
6	Write a MATLAB program to plot duty cycle v/s transmit time for wide range of battery life time for GSM mobile phone.
7	Draw Simulink block to find out Bit Error Rate for Amplitude Shift Keying (ASK) technique using: 1) Minimum distance Method, 2) Average Power Method and 3) Peak power method.
8	Draw Simulink block to find out Bit Error Rate for Frequency Shift Keying (FSK) technique.
9	Draw Simulink block to find out Bit Error Rate for Phase Shift Keying (PSK) technique.
10	To study and understand GSM system architecture.
11	To study and understand CDMA system architecture.
12	To study recent trends in cellular communication: 1) RFID, 2) WLAN, 3) Mobile Adhoc Network and 4) Wireless Sensor network

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	3EC81.1	**Exam, Assignments, Presentation, Experiments**
2.	3EC81.2	**Exam, Assignments, Presentation, Experiments**
3.	3EC81.3	**Exam, Assignments, Presentation, Experiments**
4.	3EC81.4	**Exam, Assignments, Presentation, Experiments**
5.	3EC81.5	**Exam, Assignment, Presentation, Experiments**
6.	3EC81.6	**Exam, Assignments, Presentation, Experiments**

3EC82: Applied Electronics (OE-1)
CREDITS – 4 (L=3, T=0, P=2)
3rd Year, B. Tech. (Electronics and Communication)

Course Objective :

The basics of applications based electronics fundamentals are covered for the students of different braches other than electronics and communication.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment/Instruments under CE Practical Component :

Term work [20]	**Other assessment [10]**
Attendance/Lab File , Quiz	Performance-Viva / Active learning Assignments

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage %
1.	**Operational Amplifiers :** Ideal operational amplifier, Operational amplifier Stages, Operational amplifier parameters, Equivalent circuit of op-amp, Ideal Voltage transfer Curve, Open-Loop Op-amp configurations, Closed-Loop op-amp configurations	06	15%
2	**555 Timer Circuits :** Block diagram, Use as Astable multivibrator and monostable multivibrator	04	10%
3	**Transducers :** Capacitive Transducer, Inductive Transducer, Linear Variable Differential Transformer, Oscillation Transducer, Potentiometric transducer, Electrical strain gauges, Resistance thermometer, Thermistor, Thermocouple, Piezoelectric Transducer, Photoelectric transducer	07	15%
4	**Introduction to Electronics Communication :** The significance of Human Communication, Communication systems, Types of Electronics	06	15%

	Communication, Modulation and Multiplexing, The electromagnetic Spectrum, Bandwidth		
5	**Optoelectronic Devices :** Photoconductive sensors, Photovoltaic sensors, Photo emissive sensors, Light emitters, Liquid Crystal Display, Opto-coupler	07	15%
6	**Memories and Microcontroller :** Introduction to semiconductor memories, The AVR microcontrollers' history and features, AVR architecture ,AVR programming in C.	07	15%
7	**Consumer Electronics :** Washing machines (Electronic Controller, Fuzzy logic machines and automatic washing Machines), Audio systems, I-pods, RFID, Barcode Scanner and decoder, Photocopier machines, Introduction to organic electronics and internet of things (Industry 4.0)	07	15%
	Total	44	100 %

List of References :

1. S Salivahanans, N Kumar, A Vallavaraj , "*Electronic devices and circuits*", 2nd Edition, McGraw Hill , 2008.
2. Santiram KAL, "*Basic Electronics Devices, Circuits and its Fundamentals*", 5th Edition, PHI Publication , 2006.
3. M.A. Mazidi,Sarmad Naimi,Sepehr Naimi, "*The AVR Microcontroller & Embedded Systems using Assembly and C*", 1st Edition , Pearson Education, 2011.
4. Louis E. Frenzel , "*Principles of Electonic Communication Systems*", 3rd Edition , McGraw Hill , Publication , 2014.
5. Alasdair Gilchrist, "*Industry 4.0*", Apress ,2016

Course Outcomes (COs) :

1. Understand the fundamental s of Operational amplifier and its applications.
2. Analyze and able to design sensor based applications.
3. Understand the Principles of Electronics Communication.
4. Understand and able to analyze Modern Communication systems and its applications.

5. Able to use of the CAD tools and programming of AVR on C platform.
6. Design and understands the various modern electronics based real time industrial applications.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC82.1	3	3	3	2	2	2	2	2	3	3	3	2	3	3	3
3EC82.2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3EC82.3	3	3	2	2	2	2	2	2	3	3	3	2	3	3	3
3EC82.4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3EC82.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3EC82.6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Trainer kits, breadboard, 8051 Assembly language software, Arduino board

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	*3EC82.1*	Exam, Assignments, Presentation, Experiments, Quiz
2.	*3EC82.2*	Exam, Assignments, Presentation, Experiments, Quiz
3.	*3EC82.3*	Exam, Assignments, Presentation, Experiments, field trips
4.	*3EC82.4*	Exam, Assignments, Presentation, Experiments, Quiz
5.	*3EC82.5*	Exam, Assignment, Presentation, Experiments, Quiz
6.	*3EC82.6*	Exam, Assignments, Presentation, Experiments, field trips

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	15	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)
Note: The actual distribution of marks in the question paper may vary slightly from above table.

List of Experiments :

SR No	Experiments Name
1	To study about measuring Amplitude & Frequency of signal
2	To study about Slew rate of op amp
3	To study about Op amp inverting & Non inverting configurations
4	To study & perform astable mode of IC555
5	To study & perform monostable mode OF IC555
6	To study & perform linear variable diff. transducer
7	To study about thermocouple
8	To study about working of strain gauge
9	To study about The basic of LDR
10	To study about digital modulation technique
11	To study data logger using microcontroller and display it.

Open Ended Problems:

Sr No	List of OEP on various sensors with Arduino
1	Temperature measurement using Arduino
2	Application of LDR to On/Off the bulb using Arduino
3	Humidity Measurement using Arduino
4	Soil Moisture measurement using Arduino.
5	Interface Ultrasonic Sensor with Arduino
6	Interface IR Sensor with Arduino
7	Design water level indicator with Arduino

8	Interface touch sensor with Arduino

ECIT1: Summer Internship - I
CREDITS-0 (L=0 , T=0 , P=0)
3rd *year* B. Tech. (Electronics and Communication)

Course Objective :

The students get familiar with the industry and its working environment particularly they will have hands-on training with the updated technology by getting the feel of the latest projects in industries. Being a student of Electronics and Communication Engineer, they will be skilled with recent tools, hardware and necessary software in their domain.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	00
0	0	0	0	0	0	0	0	

Details of Assessment Instruments under CE Practical Component: NA

Course Contents:

1. It is a Mandatory Non Credit course and the student has to complete an industrial internship of the duration of two weeks during the summer vacation after **Semester IV**. The internship should be carried out in any industry with relevant applications/projects of Electronics and communication engineering, preferably under the guidance of a mentor from the same industry.

2. The student will maintain a log/record of work done on a daily basis and important ideas or practices that he/she has learned during the internship. The log/record-book may also be duly signed by the student and the mentor from the industry.

3. The student will submit a detailed report and certificate issued by the industry based on the internship immediately after the completion of the internship.

4. The assessment will be based on the following
(a) Quality of the report and submission of the log-book
(b) Feedback from the industry mentor in the prescribed form
(c) A completion certificate from the industry
(d) Performance in a presentation / viva-voce exam

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
--	--	--	--	--	--

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Course Outcomes of Internship/Training (COs):

After completion of the internship students will be able:

1. To apply knowledge and skills in real-world problems through industries.
2. To function in teamwork and to use experience related to professional and ethical issues in the work environment.

Course Articulation Matrix :

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO13	PSO14	PSO15
ECIT1.1															
ECIT .2															

Delivery Methods : Through personal interactions and project-based / hands-on training in the industry.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	CE (Theory) [00]		ESE [Theory] [00]	ESE [practical] [?]	CE [Practical] [?]
		Mid Semester I [00]	Mid Semester II [00]			
1.	ECIT.1				-	-
2.	ECIT.2				-	-

3EC06 : Digital Communication
CREDITS - 3 (L = 3 , T = *0* , P = 0)

***3rd* Year, B. Tech. (*Electronics and Communication*)**

Course Objective :

To analyze and characterize the concept of digital data transmission, probability & information theory, source coding, channel coding & BER analysis of digital demodulation techniques.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme		
				Theory		Total Marks
L	T	P	C	ESE	CE	
3	0	0	3	60	40	100

Details of Assessment Instruments under CE Theory Component :

Marks [30]	**Marks [10]**	**Total CE Theory Marks**
Mid semester Exam	Attendance/ Assignments/Quiz	40

Course Contents:

Unit No.	**Topics**	**Teaching Hours**	**Weightage (%)**
1.	**Sampling & Interpolation:** Introduction, Sampling theorem, Signal reconstruction, Aliasing, Applications of sampling theorem, Quantization, Compander, Types of analog to digital modulation technique – Pulse code modulation, Differential pulse code modulation, Delta modulation, Adaptive delta modulation.	07	18
2.	**Digital data transmission:** Digital Communication system, Line coding technique and its properties, PSD of various line coding technique, Pulse shaping, ISI and its effect, Nyquist's first criteria for zero ISI, Scrambling, Regenerative Repeater, Zero forcing equalizer.	06	17

Unit No.	Topics	Teaching Hours	Weightage (%)
3.	**Basics of Probability Theory and Random Variable:** Concept of probability, Conditional probability and independent events, Bayes' theorem, random variable, types of random variable, CDF, PDF, Mean, Variance, Various Distribution functions – Bernoulli, Binomial, Poisson, Uniform, Gaussian, Chebyshev's inequality, Central limit theorem.	10	18
4.	**Information Theory & Source coding:** Measure of information, Entropy, Source encoding – Huffman code, Channel capacity of discrete memory less channel, Channel capacity of continuous channel, Channel capacity of band-limited AWGN channel and infinite bandwidth channel.	07	14
5.	**Channel Coding :** Comparison of block codes and Convolutional codes, Hamming bound Linear block code-Encoding and Decoding, Cyclic code-Encoding and Decoding, Convolutional Codes – Code tree, state diagram, trellis diagram, Maximum likelihood decoding, Sequential decoding.	07	15
6.	**Digital Modulation & Demodulation technique :** BPSK transmitter, BPSK receiver and its BER, QPSK transmitter, QPSK receiver and its BER, BER of M-ary PSK technique, M-ary QAM technique and its BER, MSK transmitter, receiver and its BER, GMSK transmitter, receiver and its BER, Comparison of BER of coherent detection technique, Case studies.	08	18
	Total	45	100

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	20	15	20	15	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References :

1. B.P. Lathi, Zhi Ding, *"Modern Digital & Analog Communication Systems"*, Oxford University Press, 4th Edition, 2010.
2. Simon Haykin, *"Digital Communication Systems"*, Wiley Publication, 2nd Edition, 2014.
3. John G. Proakis, Masoud Salehi "*Digital Communications*", McGraw Hill Higher Education, 5th Edition, 2008.
4. Bernard Sklar, *"Digital Communications — Fundamentals and Applications"*, Pearson Education, 2nd Edition, 2009.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Convert analog signal into digital signal using various modulation technique.
2. Design the PSD of various line coding technique.
3. Calculate the Mean, Variance, PDF & CDF of various distribution functions.
4. Measure entropy, average word length, efficiency of memoryless channel.
5. Generate the codeword and correct the errors of various channel coding technique.
6. Compare different digital modulating techniques and measure its bit error rate (BER).

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC06.1	3	2	2	1	1	2	1	-	1	1	1	3	3	2	2
3EC06.2	3	3	3	2	2	1	1	1	3	2	2	3	1	2	2
3EC06.3	3	3	2	2	2	1	1	1	2	2	1	3	1	2	1
3EC06.4	3	3	2	2	2	2	-	1	2	2	2	3	1	3	2
3EC06.5	3	3	2	2	1	2	-	1	3	3	2	3	1	2	2
3EC06.6	3	2	2	2	1	2	1	1	3	3	2	3	3	2	2
Average	3	2.67	2.17	1.83	1.50	1.67	0.67	0.83	2.33	2.17	1.67	3	1.67	2.17	1.83

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Assignments :

   Part I : Mathematical analysis of all modules with respect to examples and questions.

   Part II : Exercise using MATLAB Software such as plot the sampled and digital signals, sketch & compare the BER v/s SNR for all digital demodulation technique and also plot the PSD of various line coding technique etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	*3EC06.1*	Exam, Assignments, Presentations
2.	*3EC06.2*	Exam, Assignments, Presentations
3.	*3EC06.3*	Exam, Assignments, Presentations
4.	*3EC06.4*	Exam, Assignments, Presentations
5.	*3EC06.5*	Exam, Assignments, Presentations
6.	*3EC06.6*	Exam, Assignments, Presentations

3EC07: Digital Communication Laboratory

CREDIT - 1 (L=L_0, T=T_0, P=P_2)

3^{rd} Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To perform the experiments of analog to digital signal conversion, compandor, various formatting techniques, digital modulation technique and BER analysis of digital demodulation techniques.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme		
				Practical		Total Marks
L	T	P	C	ESE	CE	
0	0	2	1	40	60	100

Details of Assessment Instruments under CE Practical Component:

Marks [30]	Marks [30]	Total Marks
Attendance, Term work, Record book	Open Ended Problem, Active learning Assignments	60

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List of Experiments :

Sr. No	Aim
1	To study and understand sampling and reconstruction of the signal.
2	To study and understand TDM and PAM modulation and demodulation.
3	To study and understand PCM modulation and demodulation.
4	To study and understand Delta modulation and demodulation.
5	To Study and understand: (a) Adaptive Delta Modulation and Demodulation. (b) Continuously variable slope delta Modulation and Demodulation.
6	To study and understand slope overload and increased integrator gain in delta modulation.
7	To study and understand compressor and expander technique.
8	To study and understand various formatting techniques.
9	To study and understand Amplitude Shift Keying (ASK) modulation and demodulation.
10	To study and understand Frequency Shift Keying (FSK) Modulation and Demodulation.
11	To study and understand Phase Shift Keying (PSK) Modulation and Demodulation.
12	(a) Write a MATLAB program to plot SNR v/s BER for BPSK modulation technique using AWGN channel. (b) Write a MATLAB program to plot SNR v/s BER for BPSK modulation technique using Rayleigh channel.
13	(a) Write a MATLAB program to plot SNR v/s BER for QPSK modulation technique using AWGN channel. (b) Write a MATLAB program to plot SNR v/s BER for QPSK modulation technique using Rayleigh channel.
14	(a) Write a MATLAB program to plot SNR v/s BER for QAM modulation technique using AWGN channel. (b) Write a MATLAB program to plot SNR v/s BER for QAM modulation technique using Rayleigh channel.
15	(a) Write a MATLAB program to plot SNR v/s BER for MSK modulation technique using AWGN channel. (b) Write a MATLAB program to plot SNR v/s BER for MSK modulation technique using Rayleigh channel.
16	(a) Write a MATLAB program to plot SNR v/s BER for GMSK modulation technique using AWGN channel. (b) Write a MATLAB program to plot SNR v/s BER for GMSK modulation technique Rayleigh channel.

Lab Resources :

- Digital Communication Trainer kits.
- MATLAB Software – R2018a License Version.

List of References :

1. B.P. Lathi, Zhi Ding, *"Modern Digital & Analog Communication Systems"*, Oxford University Press, 4th Edition, 2010.
2. Simon Haykin, *"Digital Communication Systems"*, Wiley Publication, 2nd Edition, 2014.
3. John G. Proakis, Masoud Salehi "*Digital Communications*", McGraw Hill Higher Education, 5th Edition, 2008.
4. Bernard Sklar, *"Digital Communications — Fundamentals and Applications"*, Pearson Education, 2nd Edition, 2009.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Convert analog signal into digital signal using various modulation technique.
2. Design the PSD of various line coding technique.
3. Calculate the Mean, Variance, PDF & CDF of various distribution functions.
4. Measure entropy, average word length, efficiency of memoryless channel.
5. Generate the codeword and correct the errors of various channel coding technique.
6. Compare different digital modulating techniques and measure its bit error rate (BER).

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC06.1	3	2	2	1	1	2	1	-	1	1	1	3	3	2	2
3EC06.2	3	3	3	2	2	1	1	1	3	2	2	3	1	2	2
3EC06.3	3	3	2	2	2	1	1	1	2	2	1	3	1	2	1
3EC06.4	3	3	2	2	2	2	-	1	2	2	2	3	1	3	2
3EC06.5	3	3	2	2	1	2	-	1	3	3	2	3	1	2	2
3EC06.6	3	2	2	2	1	2	1	1	3	3	2	3	3	2	2
Average	3	2.67	2.17	1.83	1.50	1.67	0.67	0.83	2.33	2.17	1.67	3	1.67	2.17	1.83

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	3EC06.1	**Exam, OEP, ALA**
2.	3EC06.2	**Exam, OEP, ALA**
3.	3EC06.3	**Exam, OEP, ALA**

4.	3EC06.4	**Exam, OEP, ALA**
5.	3EC06.5	**Exam, OEP, ALA**
6.	3EC06.6	**Exam, OEP, ALA**

3EC08 : Antenna and Wave Propagation
CREDITS - 3 (L= 3 , T = *0* , P = 0)
3rd Year, B.Tech. (*Electronics and Communication*)

Course Objective :

Knowledge of Electromagnetics wave propagation in different medium is essential for the Communication Engineers. As antenna is vital part of any communication system and its knowledge is equally important as well.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component :

Exams [30]	Other assessment [10]
Mid Exam 1 & 2	Attendance , Presentations

Course Contents :

Sr. No.	Topics	Teaching Hrs.	% Weightage
1.	**Antenna Basics :** Physical concept of radiation, retarded potentials, Hertzian dipole, Definition and functions of an antenna, Antenna parameters: Radiation pattern, gain, directivity, antenna apertures, reciprocity; Radiation from dipoles of arbitrary length, Power density, radiation resistance, input	07	15

	impedance, beam width, bandwidth, beam efficiency and polarization, Friss transmission formula. Retarded potential, Radiation from a current element and monopole – Radiation of half-wave and center-fed dipole – Near and far fields, current distribution of dipole antennas.		
2.	**<u>Wire antennas :</u>** Short electric dipole radiation of short dipole, Long wire antennas, V-antennas, Rhombic Antennas, small loop antenna, Helical antennas, location methods of Feeding antennas, folded dipole antennas.	**8**	**20**
3.	**<u>Antenna Arrays:</u>** Arrays: electric fields from two, three and N element arrays, linear arrays: Dolph-Tchebysheff distribution. Broad-side array and End-Fire array -Method of pattern multiplication, practical design consideration.	**7**	**15**
4.	**<u>Microwave antennas :</u>** Reflector Antennas: Yagi-Uda antenna, corner reflectors, Parabola, paraboloid reflector, reflectors, cassegrain feed of other reflector antennas, Slot antenna-Babinet's principle, Microstrip antennas, Lens antennas, Introduction to 5G antenna	**10**	**20**
5.	**<u>Antenna measurements:</u>** Measurement of far-field radiation pattern, gain, phase, directivity, efficiency and polarization. Anechoic Chamber	**5**	**15**
6.	**<u>Wave Propagation</u> :** Factors involved in the propagation of radio waves - Ground wave, reflection of radio waves by the surface of the earth - Space wave propagation, considerations in space wave propagation, atmospheric effect in space wave propagation - Ionosphere and its effect on radio waves, Mechanism of ionosphere propagation -	**8**	**15**

	Ray paths – Skip distance -Critical frequency-Maximum usable frequency - Fading of signal - Types of fading-Diversity reception.		
	Total	**45**	**100**

List of References :

1. J.D. Krauss, "*Antennas for all applications*", Fourth Edition, MH publication, 2010
2. C. A. Balanis, "*Antenna Theory: Analysis and design"*, Third Edition, Wiley India, 2005.
3. Jordan & Balmain, "*Electromagnetic wave & radiating systems*", Second edition, Prentice-Hall, 2000.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Identify the importance of EM waves in Antenna.
2. Understand and measure the basic antenna parameters.
3. Analyze the characteristic of dipole and loop antennas
4. Comprehend Microwave antennas and their design.
5. analyze matching and feeding networks for antennas.
6. Compare various modes of radio wave propagation and understand the significant role of atmosphere.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC08.1	3	3	2	1	2	2	2	-	2	1	-	2	1	1	2
3EC08 .2	2	3	2	2	1	2	2	-	1	1	-	1	1	1	2
3EC08.3	3	2	2	1	3	2	2	-	2	1	-	2	1	1	2
3EC08.4	2	2	1	2	2	2	2	-	2	1	-	2	1	1	2
3EC08.5	3	3	3	3	2	2	2	-	3	1	-	3	2	1	1
3EC08.6	1	2	1	2	1	2	2	-	1	1	-	1	1	1	2
Average	2.33	2.5	1.83	1.83	1.83	2	2	-	1.83	1	-	1.83	1.16	1	1.83

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note : This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Delivery Methods :

1. Lectures through Blackboard/ power-point slides.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	*3EC08.1*	**Exams, Assignments, Presentations**
2.	*3EC08 .2*	**Exams, Assignments, Presentations**
3.	*3EC08.3*	**Exams, Assignments, Presentations**
4.	*3EC08.4*	**Exams, Assignments, Presentations**
5.	*3EC08.5*	**Exams, Assignments, Presentations**
6.	*3EC08.6*	**Exams, Assignments, Presentations**

3EC09 : Antennas and Wave Propagation Laboratory
CREDITS - 1 (L=0, T=*0*, P=2)
3rd Year, B.Tech. (*Electronics and Communication*)

Course Objective :

Knowledge of Electromagnetics wave propagation in different medium is essential for the Communication Engineers. As antenna is vital part of any communication system and its knowledge is equally important as well.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

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Details of Assessment Instruments under CE Practical Component :

File	Attendance	Assignments	Open Ended Problems (OEP)	Active Learning Assignments (ALA)	Total
10	10	10	20	10	60

List of Experiments :
This shall consist of at least 10 Practical's based on trainer kits & software.

Sr No	Experiment Title
1.	To study various antennas, its application and tentative radiation pattern. (study experiment)
2.	To study and observe the radiation patter of strait dipole antenna.
3.	To study and compare the radiation patter of folded dipole with straight dipole antenna and comment on the radiation resistance and it's matching with free space.
4.	To study and compare the radiation pattern of 3-element and 5-element Yagi and give your comment on effect of addition of parasitic elements to the given antenna.
5.	To study the variation of radiated field with distance from transmitting antenna.
6.	To study and plot the radiation pattern of the Log-Periodic antenna and observe its frequency independency.
7.	To study and observe the radiation pattern of the horn antenna.
8.	Introduction to HFSS (High Frequency Simulation Software).
9.	Micro Strip antenna design and simulation using HFSS.
10.	Study of Antenna Measurement setup in Anechoic chamber.

List of References :
1. J.D. Krauss, "*Antennas for all applications*", Fourth Edition, MH publication, 2010
2. C. Balanis, "*Antenna Theory: Analysis and design*", Third Edition, Wiley India, 2005.
3. Jordan & Balmain, "*Electromagnetic wave & radiating systems*", Second edition, Prentice-Hall, 1968.

Course Outcomes (COs) :
By learning this course students will be able to …

1. Understand the importance of EM waves in Antenna.
2. Identify and measure the basic antenna parameters
3. Identify and understand different types of antennas, radiation pattern.
4. analyze matching and feeding networks for antennas.
5. analyze simple antenna arrays, dipole, loop, slot and horn antennas
6. Identify the characteristics of radio wave propagation.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC09.1	3	3	1	2	1	1	1	-	1	-	-	1	-	1	2
3EC09..2	2	3	2	2	1	1	1	-	2	-	-	1	2	1	2
3EC09.3	3	2	2	2	2	1	-	-	2	-	-	1	2	1	2
3EC09.4	2	2	2	2	2	1	-	-	2	-	-	1	2	1	2
3EC09.5	3	3	3	2	2	1	-	-	2	-	-	1	2	1	2
3EC09.6	1	1	1	2	1	1	1	-	-	-	-	1	2	1	2
Average	2.33	2.33	1.83	2	1.5	1	0.5	-	1.5	-	-	1	1.66	1	2

Delivery Methods :

Laboratory: Performance of Experiments Using available Antenna Trainer kits, RF Generator and RF Detector, Oscilloscope and HFSS software tool etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	*3EC09.1*	Tutorials
2.	*3EC09 .2*	Experiments
3.	*3EC09.3*	Experiments
4.	*3EC09.4*	Experiments , expert lecture
5.	*3EC09.5*	Experiments , expert lecture
6.	*3EC09.6*	Tutorials

3EC10 : Advance Microcontroller
CREDITS - 2 (L=2, T=0, P=0)
3rd Year, B. Tech. (*Electronics and communication*)

Course Objective :

To gain knowledge and skills in the field of embedded system covering various advanced microcontroller.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
2	0	0	2	60	40	00	00	100

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Details of Assessment Instruments under CE Theory Component : (40 marks)

Mid Semester Exams	Attendance/Assignments/Quiz	Total
30	10	40

Course Content:

Unit. No.	Content	Teaching Hr.	Weightage
1	**ARM Embedded Systems and ARM Processor Fundamentals :** The RISC design philosophy, ARM design philosophy, ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline-Characteristics.	05	15%
2	**ARM Instruction Set** : General Structure of ARM assembly module, Assembler directives, Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples- Data processing, Arithmetic & logical, Branch, Load-store. Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb. Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency, IRQ and FIQ.	06	20%
3	**LPC2148 ARM CPU and Peripherals** : LPC 2148- Salient features, applications, Pin Connect Block- Features, Register description with example. GPIO-Features with examples, PLL-Features with examples, Timers-Features with examples	07	25%
4	**Introduction to MSP430 Architecture** : Features of MSP430 suitable embedded application, Different families and naming of MSP430, MSP430 Architecture, Program Counter (PC), Stack Pointer (SP), Status Register (SR), Constant Generators,	06	20%

	General Purpose Registers, Addressing Modes, Low-Power Modes of Operation of MSP430		
5	**MSP430 Assembly and C Programming :** MSP430 Instruction Set, Classification, Movement Instructions, Arithmetic and Logic Instructions with Two Operands, Shift and Rotate Instructions, Flow of Control instructions. Simple assembly language programs, simple Embedded C programs such as programs to control LEDs, access switches, generating delays and so on.	**06**	**20%**
	Total	**30**	**100**

List of References :

1. Lyla B.Das, "*Embedded Systems an Integrated Approach*", 1st Edition, Pearson, 2013.
2. Steve Furber , "*ARM System –On –Chip architecture*", 2nd Edition, Addision Wesley, 2000.
3. Wayne Wolf "*Computers as Components, Principles of Embedded Computing Systems Design*", 2nd Edition, Elsevier, 2008
4. K.V. Shibu, "*Introduction to Embedded Systems*",1st edition, McGraw Hill Education.
5. Manuel Jiménez, Rogelio Palomera, Isidoro Couvertier "*Introduction to Embedded Systems Using Microcontrollers and the MSP430*" Springer Publications, 2014.
6. John H. Davies "*MSP430 Microcontroller Basics*", Elsevier Ltd Publications, 2008.

Course Outcomes (COs) :
At the end of this course students will be able to.....

1. Become familiar with importance and applications of advance microcontroller.
2. Understand architecture and instruction set of ARM processor
3. Design and Write hybrid (assembly & C) program for ARM processor.
4. Understand the architecture, instruction, addressing modes and applications of MSP430.
5. Design and Develop application programs using MSP430 with assembly and C language.

Suggested specification table with marks (Theory)

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC10.1	3	1	1	1	2	1	-	-	2	-	-	2	3	2	3
3EC10.2	3	1	1	1	2	2	-	-	1	-	-	2	2	1	2
3EC10.3	2	3	1	1	3	1	-	-	1	-	-	2	3	2	3
3EC10.4	3	1	2	1	2	2	-	-	2	-	-	-	2	1	2
3EC10.5	3	2	1	1	3	1	-	-	1	-	-	2	1	1	3
AVG.	2.8	1.6	1.2	1	2.4	1.4	-	-	1.4	-	-	1.6	2.2	1.4	2.6

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1	*3EC10.1*	Exams , Quiz
2	*3EC10.2*	Exams , Quiz
3	*3EC10.3*	Exam , Assignments
4	*3EC10.4*	Exam , Assignments
5	*3EC10.5*	Exam , Assignments, Presentations

3EC11: Advance Microcontroller Lab

CREDITS – *1* (L = *0*, T = *0* , P = *2*)

3^{rd} Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To provide in depth knowledge of ARM Controller, LPC2148 and MSP430 architecture using assembly as well as C language programming.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	

0	0	2	1	00	00	40	60	100

Details of Assessment Instruments under CE Practical Component :

Lab File	Attendance	Assignments	Open Ended Problem (OEP)	Active Learning Assignments (ALA)	Total
15	10	10	15	10	60

List of Experiments :

Sr. No.	Name of Experiment
1.	Introduction to µVision IDE for ARM7
2.	To study Load and Store Architecture in ARM7
3.	**Write Assembly Language Program using KEIL uvision5 ;** a) to add two 32bit numbers. b) to add two 64bit numbers. c) to multiply two 32bit numbers. d) to sort the numbers in ascending order. e) to sort the numbers in descending order. f) to find lowest number among 10 numbers. g) to find lowest number among 10 numbers. h) to divide numbers using repeated subtraction.
4.	a) Interfacing LED on P0 and P1using LPC 2148 ARM 7 controller. b) Generate Blinking pattern of LED interfaced on P0 and P1 using LPC 2148 ARM 7 controller(using Software delay)
5.	To study and configure TIMER block of ARM 7 controller and generate delay and Blink LED interfaced on P0 using LPC 2148 ARM 7 controller.
6.	To study and configure PWM block of ARM 7 controller and set different brightness level of LED interfaced on P0 using LPC 2148 ARM 7 controller
7.	To study and configure UART block of ARM 7 controller and send "BVM EC DEPARTMENT" string using LPC 2148 ARM 7 controller to PC.
8.	Write a program: a) To Interface LCD using LPC 2148 ARM 7 controller to display string "BVM EC DEPARTMENT".

	b) To Scroll Message "BVM EC DEPARTMENT" from right to left on LCD using LPC 2148 ARM 7 controller
9.	**Write Programs using MSP430 :** a) Data Transfer and Arithmetic Instruction Programming in MSP430 b) Boolean & Logical Instructions Programming in MSP430.
10	Introduction to MSP430 Kit and Programming Environment with program to work with ports.
11	Configure timer block with capture/compare channel 0 & 1 to generate different frequency signal on MSP430 kit.
12	Configure watchdog timer & interval mode on MSP430 kit.
13	Test various Power Down modes in MSP430 kit.

Course Outcomes (COs):

1. Understand the need of advance controller in Embedded Systems
2. Familiarize with the assembly level and C programming using ARM Controller.
3. Utilized and understand the Keil µVision-3/4 and Code Composer Studio tool.
4. Analyze problems and apply a combination of hardware and software to address the problem.
5. Troubleshoot interactions between software and hardware.
6. Design and implement some applications Using MSP 430 low power microcontroller

Suggested specification table with marks (Practical) :

Distribution of Practical Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC11.1	3	2	2	1	3	1	1	-	-	-	-	-	3	2	2
3EC11.2	3	2	3	2	3	2	2	-	-	-	-	-	3	2	2
3EC11.3	3	3	3	2	3	2	2	1	-	-	-	1	3	3	2
3EC11.4	2	2	3	2	3	1	1	1	-	-	1	2	2	3	3
3EC11.5	3	3	3	3	3	3	2	1	-	-	1	2	3	3	3
3EC11.6	3	2	2	3	3	2	1	-	-	-	1	2	2	3	3
Average	2.83	2.33	2.66	2.16	3.00	1.83	1.5	0.5	-	-	0.5	1.16	2.66	2.66	2.5

Delivery Methods :

Laboratory: Performance of Experiments using software Keil µVision-3/4 and Code Composer Studio and hardware LPC2148 and MSP430.

Open Ended Projects :

- Wireless relay control using Bluetooth using ARM7
- Real-Time Interaction with Smart Wheelchair using ARM 7
- An Embedded Real-Time Finger-Vein Recognition System for Mobile Devices using ARM 7
- Head Movement Controlled Wheel Chair Using MEMS Sensors and ARM 7
- Obstacle Avoidance Based on Fuzzy Controller and Ultrasonic Sensors using ARM 7
- Vehicle To Vehicle Communication Using Wi-Fi , ARM
- Smart Toll using WIFI Protocol - ARM7
- ARM-7 Vehicle location using GSM / GPS

Constituent COs in Assessment Tools :

Course Outcomes	Assessment Tools
3EC11.1	Experiments, Assignments, OEP and ALA
3EC11.2	Experiments, Assignments, OEP and ALA
3EC11.3	Experiments, Assignments, OEP and ALA
3EC11.4	Experiments, Assignments, OEP and ALA
3EC11.5	Experiments, Assignments, OEP and ALA
3EC11.6	Experiments, Assignments, OEP and ALA

3EC12: Digital Signal Processing

CREDITS - C_3 ($L=L_3$, $T=T_0$, $P=P_0$)

3^{rd} Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To provide a thorough understanding and working knowledge of various transform techniques to analyze discrete time signals and systems in time and frequency domain, design of digital filters, advanced DSP techniques and DSP processor with its applications.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component :

Internal Exams **[30 Mark]**	Continuous Assessment **[10 Mark]**
Mid Sem 1 & Mid Sem 2 Exam	**Quiz** based on continuous assessment carried out during the semester as declared by the course coordinator in first week of beginning of the semester.

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage
1.	**Discrete-Time Signals and Systems:** Introduction to DSP, Discrete-Time Signals: Sequences, Discrete-Time Systems, Linear Convolution and its Properties, Correlation of Discrete-Time Systems, Representation of Sequences by Discrete Time Fourier Transform, (DTFT), Properties of DTFT, Inverse DTFT.	05	10%
2.	**The z-Transform and Analysis of LTI Systems:** Introduction, The Z-transform, Properties of ROC for Z-transform, Z-transforms Properties, The Inverse Z-transform, Analysis of LTI Systems using Z-transform, System Stability and Z-transform, The Frequency Response of LTI Systems, System Functions for Systems with LCCDE, Frequency Response of Rational System Functions, Relationship between Magnitude & Phase, All Pass Systems, Inverse Systems, Minimum, Maximum and Mixed Phase Systems, Systems with Linear Phase.	08	15%

Unit No.	Topics	Teaching Hours	Weightage
3.	**Structures for Discrete-Time Systems:** Introduction, Block Diagram and Signal Flow Graph Representations of LCCDE, Basic Structures of IIR Systems, Direct Forms, Cascade Forms, Parallel Forms, Transposed Forms, Direct and Cascade Form Structures for FIR Systems, Linear Phase FIR Structure, Effects of Co-efficient Quantization.	05	15%
4.	**Filter Design Techniques:** Introduction, Fundamentals of Filter Design, Ideal Filters and Approximations, Design of Discrete-Time IIR Filters from Continuous-Time Filters, Approximation of Derivatives, Impulse Invariance and Bilinear Transformation Methods, Frequency Warping Concept, Design of Analog Butterworth and Chebyshev Filters, Design of FIR filters by Windowing Techniques, Comparison between IIR and FIR Filters.	08	20%
5.	**Discrete Fourier Transform and Fast Fourier Transform:** Introduction, Representation of Periodic Sequences: The Discrete Fourier Series (DFS) and Its Properties, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform (DFT), Properties of DFT, Linear Convolution using DFT, Linear Filtering Methods Based on DFT, The Discrete Cosine Transform, Efficient Computation of DFT: FFT Algorithms, Radix-2 and Radix-4 FFT Algorithms, Bit Reversal, The Goertzel Algorithm.	08	15%
6.	**Advance DSP Techniques :** **Multirate Digital Signal Processing:** Introduction, Decimation, Interpolation, Sampling Rate Conversion by Rational Factor. **Optimal and Adaptive Filters :** Introduction, Minimum Mean Square Error and Linear Minimum Mean Square Error Criteria, Wiener Filter, Linear Prediction, LMS Algorithm, Adaptive Filter Applications.	07	15%
7.	**Architecture of DSP Processors & Applications :** Introduction, Characteristics of DSP algorithms and Hardware Requirements, Von Neumann Architecture, Harvard Architecture, Parallelism and Hardware Units of Typical Digital Signal Processor, Architectural details of TMS320C6x.	04	10%

Unit No.	Topics	Teaching Hours	Weightage
	Total	45	100%

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
10%	25%	25%	20%	10%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

List of References:

4. Oppenheim, Schafer & Buck, *"Discrete Time Signal Processing"*, 2nd Edition Pearson Education Publication, 2003.
5. Proakis & Manolakis, *"Digital Signal Processing: Principles, Algorithm & Application"*, 4th edition, Pearson Education, 2006.
6. S. K. Mitra, *"Digital Signal Processing – A Computer Based Approach"*, 3rd Edition, Tata McGraw Hill, 2006.
7. S. Salivahanan, *"Digital Signal Processing"*, 3rd Edition, McGraw Hill Education, 2014.

Course Outcomes (COs) :

1. Understanding of frequency domain analysis of discrete time signals.
2. Use of various transforms to acquire knowledge about discrete time systems.
3. Design and analysis various digital filters for processing of discrete time signals.
4. Employ multiple sampling rates in the processing of digital signals.
5. Interpret the necessity of adaptive filters in communication applications.
6. Understand the key architectural features of Digital Signal Processor.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC12.1	3	2	2	1	3	1	1	-	-	-	-	-	3	2	2
3EC12.2	3	2	3	2	3	2	2	-	-	-	-	-	3	2	2
3EC12.3	3	3	3	2	3	2	2	1	-	-	-	1	3	3	2
3EC12.4	2	2	3	2	3	1	1	1	-	-	1	2	2	3	3
3EC12.5	3	3	3	3	3	3	2	1	-	-	1	2	3	3	3
3EC12.6	3	2	2	3	3	2	1	-	-	-	1	2	2	3	3
Average	**2.83**	**2.33**	**2.66**	**2.16**	**3.00**	**1.83**	**1.5**	**0.5**	**-**	**-**	**0.5**	**1.16**	**2.66**	**2.66**	**2.5**

Delivery Methods :

Lectures through Blackboard and Power-point slides.

Constituent COs in Assessment Tools :

Course Outcomes	Assessment Tools
3EC12.1	Exam and Quiz
3EC12.2	Exam and Quiz
3EC12.3	Exam and Quiz
3EC12.4	Exam and Quiz
3EC12.5	Exam and Quiz
3EC12.6	Exam and Quiz

3EC13 : Digital Signal Processing Laboratory

CREDITS – 1 (L=0, T=0, P=2)

3rd Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To provide a thorough understanding and working knowledge of various transform techniques to analyze discrete time signals and systems in time and frequency domain, design of digital filters, advanced DSP techniques and DSP processor with its applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

Details of Assessment Instruments under CE Practical Component :

Tutorial/Practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

File	Attendance	Assignments	Open Ended Problem (OEP)	Active Learning Assignments (ALA)	Total
10	10	10	20	10	60

List of Experiments :

Sr. No.	Name of Experiment
1.	Introduction to MATLAB and generation of discrete time sinusoid signal with noise component. Smoothing the signal by applying Moving Average Filter in MATLAB. Also find magnitude and phase plot of Moving Average System.
2.	Write a MATLAB program (a) To perform Convolution of two discrete time sequences. (b) To compute Cross-correlation and Auto-correlation of two discrete time sequences
3.	Write a MATLAB program (a) To find the Fourier series of periodic square wave for odd symmetry and even symmetry using DTFT. (b) To find the Fourier series of periodic triangular wave for odd symmetry and even symmetry using DTFT. (c) To study of aliasing in sampling process using DTFT.
4.	Write a MATLAB program to design simple low pass filter using IDTFT.
5.	Write a MATLAB program (a) To find z-transform and inverse z-transform of various function. (b) To find impulse response and step response of given difference equation using z-transform. (c) To plot pole-zero of given system transfer function and check the stability.
6.	Design a Simulink Model in MATLAB for Direct form – I & II form realization of the given IIR system function.
7.	Write a MATLAB program (a) To find DFT and IDFT of a sequence without using the in-built function. (b) To Find the circular convolution of given sequences. (c) To find linear convolution of given sequences using DFT.

8.	Write a MATLAB program to compute DIT-FFT and DIF-FFT of given discrete time sequence without using the in-built function.
9.	Write a MATLAB program for Analog to Digital transformation using impulse invariance method and bilinear transformation method.
10.	Write a MATLAB program to design digital Butterworth (a) Low pass filter (b) High pass filter (c) Band pass filter (d) Band stop filter
11.	Write a MATLAB program to design digital Chebyshev(Type-1) (a) Low pass filter (b) High pass filter
12.	Write a MATLAB program to plot magnitude response and phase response FIR Lowpass filter using Rectangular window and Hamming window.
13.	Write a MATLAB program for down-sampling and up-sampling the sum of sinusoids using decimation and interpolation by integer factor of 20.
14.	Introduction to DSP processor TMS 320C6713 DSK and Code Composer Studio. Also generate the sine and square wave in DSK6713 using Code Composer Studio.

Course Outcomes (COs) :

By learning this course student will be able to:
1. Understanding of frequency domain analysis of discrete time signals.
2. Use of various transforms to acquire knowledge about discrete time systems.
3. Design and analysis various digital filters for processing of discrete time signals.
4. Employ multiple sampling rates in the processing of digital signals.
5. Interpret the necessity of adaptive filters in communication applications.
6. Understand the key architectural features of Digital Signal Processor.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC13.1	3	2	2	1	3	1	1	-	-	-	-	-	3	2	2
3EC13.2	3	2	3	2	3	2	2	-	-	-	-	-	3	2	2
3EC13.3	3	3	3	2	3	2	2	1	-	-	-	1	3	3	2
3EC13.4	2	2	3	2	3	1	1	1	-	-	1	2	2	3	3
3EC13.5	3	3	3	3	3	3	2	1	-	-	1	2	3	3	3
3EC13.6	3	2	2	3	3	2	1	-	-	-	1	2	2	3	3

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
Average	2.83	2.33	2.66	2.16	3.00	1.83	1.5	0.5	-	-	0.5	1.16	2.66	2.66	2.5

Delivery Methods:

Laboratory: Performance of Experiments using software Matlab and hardware TMS 320C6713 DSK.

Design based Problems (DP)/Open Ended Problem:

Apply Digital Signal Processing technique to any one specific area like Speech signal processing, Image processing, Audio signal processing, Bio-medical Instrumentation, Encoding of signals, Signal compression etc. Develop a program for the same using MATLAB of equivalent software.

Constituent COs in Assessment Tools :

Course Outcomes	Assessment Tools
3EC13.1	Experiments, Assignments, OEP and ALA
3EC13.2	Experiments, Assignments, OEP and ALA
3EC13.3	Experiments, Assignments, OEP and ALA
3EC13.4	Experiments, Assignments, OEP and ALA
3EC13.5	Experiments, Assignments, OEP and ALA
3EC13.6	Experiments, Assignments, OEP and ALA

3EC14: Scripting Languages

CREDITS – 1 (L= *0* , T=*0* , P=*2*)

3rd Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To familiarize students with the Linux environment with basic command and to learn the fundamental scripting languages using Perl and Python.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	00	00	40	60	100

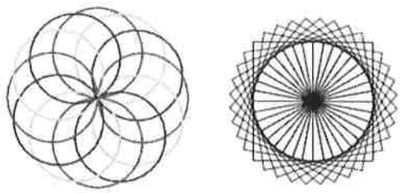
Details of Assessment Instruments under CE Practical Component: (60 marks)

Lab File	Attendance	Open Ended Problem (OEP)	Active Learning Assignments (ALA)	Total
20	10	15	15	60

List of Experiments :

Sr. No.	Name of Experiment
1.	**Introduction:** a) To Anaconda and Jypiter notebook b) To NumPy and Pandas
2.	**Operations :** a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
3.	**Control Flow :** a) Write a Program for checking whether the given number is a even number or not. b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10 c) Write a program using for loop that loops over a sequence. What is sequence? d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
4.	**Control Flow – Continued :** a) Find the sum of all the primes below two million.

	Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ... b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.
5.	**Data Structures:** a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure. c) Write a program combine_lists that combines these lists into a dictionary. d) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
6.	**Files :** a) Write a program to print each line of a file in reverse order. b) Write a program to compute the number of characters, words and lines in a file.
7.	**Functions:** a) Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius If (distance between two balls centers) <= (sum of their radii) then (they are colliding) b) Write a function to find mean, median, mode for the given set of numbers in a list.
8.	**Functions – Continued:** a) Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b. b) Write a function dups to find all duplicates in the list. c) Write a function unique to find all the unique elements of a list.
9.	**Functions - Problem Solving:** a) Write a function cumulative_product to compute cumulative product of a list of numbers. b) Write a function reverse to reverse a list. Without using the reverse function. c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.
10.	**Multi-D Lists:** a) Write a program that defines a matrix and prints b) Write a program to perform addition of two square matrices

	c) Write a program to perform multiplication of two square matrices
11.	**OOP:** a) Class variables and instance variable and illustration of the self variable i. Robot ii. ATM Machine
12.	**GUI, Graphics:** a) Write a GUI for an Expression Calculator using tk. b) Write a program to implement the following figures using turtle 
13.	**Search and Sorting:** a) To write a Python Program to perform Linear Search. b) To write a Python Program to perform Binary search. c) To write a Python Program to perform Selection sort. d) To write a Python Program to perform Insertion sort. e) To write a Python Program to perform Merge sort.

List of References :

1. Andrew Mallett, "*Mastering Linux Shell Scripting*", 1st Edition , Packt Publishing, December 2015
2. Randal L. Schwartz, Brian D. Foy, Tom Phoenix, "*Learning Perl*", 6th Edition, O'Reilly, July 2011
3. John Paul Mueller, "*Beginning Programming with Python for Dummies*" Paperback, John Wiley & Sons, October 2014.

Course Outcomes (Cos) :

At the end of this course students will be able to ....

1. Understand the working environment of LINUX OS including its file system.
2. Identify and Use LINUX utilities for file processing operations with appropriate security.
3. Able to understand the basic concepts scripting using Perl.
4. Develop, Design and Run Python script using different IDE.
5. Interpret the fundamental Python syntax, semantics and be fluent in the use of Python control flow statements.
6. Learn and Implement various scripts using python library including string, list, dictionary and its operations etc.

Suggested specification table with marks (Practical) :

Distribution of Practical Marks(%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	10	10	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC14.1	3	1	1	1	2	1	-	-	2	-	-	2	3	2	3
3EC14.2	3	1	1	1	2	2	-	-	1	-	-	2	2	1	2
3EC14.3	2	3	1	1	3	1	-	-	1	-	-	2	3	2	3
3EC14.4	3	1	2	1	2	2	-	-	2	-	-	-	2	1	2
3EC14.5	3	2	1	1	3	1	-	-	1	-	-	2	1	1	3
3EC14.6	2	1	2	1	2	1	-	-	1	-	-	2	1	1	3
AVG.	2.67	1.5	1.33	1	2.33	1.33			1.33			2	2	1.33	2.67

Delivery Methods :

1. Laboratory exercises using Linux Operating System, Perl and Python.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1	*3EC14.1*	Experiments
2	*3EC14.2*	Experiments
3	*3EC14.3*	Experiments, Assignments etc
4	*3EC14.4*	Experiments, Assignments etc
5	*3EC14.5*	Experiments, Assignments, OEP and ALA etc
6	*3EC14.6*	Experiments, Assignments, OEP and ALA etc

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3EC44 : Introduction to Real Time Operating System
CREDITS - 3 (L= 3, T = *0*, P = 0)
3rd Year, B. Tech. (*Electronics and communication*)

Course Objective :

To obtain a broad understanding of the technologies and applications for the domain of real-time operating system.

Teaching and Assessment Scheme :

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component: (40 marks)

Mid Semester Exams	Attendance/Assignments/Quiz	Total
30	10	40

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction :** Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling.	08	15%
2	**Basics of real-time concepts :** Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel.	10	25%

Unit No.	Topics	Teaching Hours	Weightage
3	**Process Management :** Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing Mutex, Mutex internals.	10	25%
4	**Inter-Process Communication :** Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, **Pipes Memory Management** : Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection	09	20%
5.	**Case Studies :** Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, ultron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling	08	15%
	Total	45	100

List of References :

1. Raj Kamal, "*Embedded Systems – Architecture, Programming and Design*", 2nd Edition, McGraw Hill,2009
2. J. J Labrosse, "*MicroC/OS-II: The Real –Time Kernel*", 2nd Edition, Newnes, 2002.
3. Jane W. S. Liu, "*Real-time systems*", 1st Edition, Prentice Hall, 2000.
4. Philips A. Laplante, "*Real-Time System Design and Analysis*", 3rd Edition, John Wiley & Sons, 2004
5. Doug Abbott, "*Linux for Embedded and Real-Time Applications*", 2nd Edition, Newnes, 2011.

Course Outcomes (COs):

By learning this course student will be able to …

1. Understand the features and structures of practical Operating System implementations.
2. Acquire practical knowledge Real Time Operating Systems used in embedded system.
3. Understand the use of multitasking techniques in Real Time Systems.
4. Compare different scheduling algorithms and the schedulability criteria.

5. Analyze real time systems with regard to keeping time and resource restrictions.

Suggested specification table with marks (Theory)

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	10	10	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Articulation Matrix :
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC44.1	3	1	1	1	2	1	-	-	2	-	-	2	3	2	3
3EC44.2	3	1	1	1	2	2	-	-	1	-	-	2	2	1	2
3EC44.3	2	3	1	1	3	1	-	-	1	-	-	2	3	2	3
3EC44.4	3	1	2	1	2	2	-	-	2	-	-	-	2	1	2
3EC44.5	3	2	1	1	3	1	-	-	1	-	-	2	1	1	3
AVG.	2.8	1.6	1.2	1	2.4	1.4	-	-	1.4	-	-	1.6	2.2	1.4	2.6

Delivery Methods :

Lectures through Blackboard/ power-point slides, videos, pictures.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	*3EC44.1*	**Exam, Assignments etc**
2.	*3EC44.2*	**Exam,Assignments, Presentation etc**
3.	*3EC44.3*	**Exam, Quiz etc**
4.	*3EC44.4*	**Exam, Assignments etc**
5.	*3EC44.5*	**Exam, Presentation etc**

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3EC45 : OPTICAL FIBER COMMUNICATION

CREDITS - 3 (L=3, T=*0*, P=*0*)

3rd Year, B. Tech. (*Electronics and communication*)

Course Objective :

To familiarize students with the propagation of light signal through optical fibers, the power penalty in a link, fiber amplifiers, coupling of power to optical fibers and losses, etc.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Component:

Exams [30]	Other assessment [10]
Mid Exam 1 & 2	Attendance , Presentations/Quiz

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1	**Basic principles of light propagation :** Electromagnetic Spectrum, Optical Spectral Bands, Evolution of Fiber Optic System, Elements of Optical Fiber Transmission Link. Nature of Light, Basic Optical Laws, Propagation of Light in Fiber, Wavelengths, Optical Power, Types of Optical Fiber, Fiber Fabrication, Fiber Cables.	12	20
2	**Optical signal distortion:** Attenuation , Fiber Losses , Signal Distortion in Optical Waveguide, Pulse Broadening in Graded Index Fiber, Mode Coupling.	06	15

Unit No.	Topics	Teaching Hours	% Weightage
3.	**Optical sources :** Light Emitting Diode (LEDs)-Structures, Materials, Figure of Merits, Characteristics & Modulation, LASER Diodes -Modes & Threshold Conditions, Resonant Frequencies, Structures, Characteristics and Figure of Merits, Single-Mode LASER, Modulation of Laser Diodes. Source To Fiber Power Launching, Lensing Schemes, Fiber To Fiber Joints, Connectors, Splicing.	06	15
4.	**Receiver systems :** Principles of Operation, Types, Characteristics, Figure of Merits of Detectors Photodiode Materials, Receiver Operation, Receiver Sensitivity, Structures For InGaAs APDs System Performance Evaluation Criteria, Eye Diagram, and BER	06	15
5.	**Transmission System and amplification:** Concept of Digital Link, Point To Point Link, System Design Considerations, Link Power Budget, Rise Time Budget, Power Penalty. Principles of WDM, DWDM, Active & Passive Optical Components, Tunable sources and Filters, Principle of Optical Amplification, Erbium-Doped Fiber Amplifiers, Raman Amplifiers, Semiconductor Optical Amplifiers. SONET/SDH, Optical switching.	08	20
6.	**Advances in Optical Fiber Systems and Measurements:** RefractiveIndex Measurements, Attenuation Measurement, Dispersion Measurement, OTDR Field Applications, Optical Performances Monitoring, optical fiber system performance measurements , introduction to next generation technology Case studies : field visit to telecom industries to observe real time practical problems, Light Fidelity (Li-Fi) technology based problems	07	15
	Total	45	100

List of References :

1. Gerd Keiser, "*Optical Fiber Communications*", Mc Graw Hill, 5th Edition,2017.
2. G.Agrawal, "*Fiber-optic Communication Systems*", John Wiley and sons,4th Edition,2010.
3. John M. Senior, "*Optical Fiber Communication*", PHI, 3rd Edition, 2010.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand the basic concept of optical fiber communication, fiber modes, and structure configurations.
2. Evaluate the significance of the different kinds of losses, signal distortion in optical system performance.
3. Clarify the various optical source materials, LED and Laser structures, quantum efficiency.
4. Analyze the fiber optical receiver operation and configuration.
5. Study and measure the system performance of optical transmitters, receivers, and optical amplifiers.
6. Analyze optical fiber link with encapsulation of different system components.

Course Articulation Matrix:

Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC45.1	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
3EC45.2	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
3EC45.3	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
3EC45.4	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
3EC45.5	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
3EC45.6	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1
Avg.	3	2	2	3	3	1	1	-	1	-	-	1	2	2	1

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate
C: Create and above Levels (Revised Bloom's Taxonomy)
Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly.

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Fiber Optic Trainer kits, Breadboard, Active & Passive Components, ICs, Function Generator, Oscilloscopes, Digital Multimeter, and Power Supply, etc.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	*3EC45.1*	**Assignments**
2.	*3EC45.2*	**Exam, Assignments, Presentation, Experiments**
3.	*3EC45.3*	**Assignments, Experiments**
4.	*3EC45.4*	**Exam, Assignments, Experiments**
5.	*3EC45.5*	**Exam, Presentation, Experiments**
6.	*3EC45.6*	**Exam, Assignments, Presentation, Experiments**

Open ended Problems :

1. Calculation of G. I. fiber parameters like Normalized frequency, No. of Guided Modes b base on given data.
2. Evaluating the S.I. fiber parameters based on given data.
3. Calculation of fiber optical sources parameters like LED, LASER based on given data.
4. Analysis of power link budget and various parameters.
5. Evaluate and calculations of Various photo detectors (PIN , APD) parameters based on given data.

Note : Field Visit to BSNL/Reliance Telecommunication , Vodafone etc should be arranged.

3EC46: SATELLITE COMMUNICATION
CREDITS - 3 (L=3, T=0, P=0)
3rd Year, B. Tech. (*Electronics and communication*)

Course Objective :

To understand basic aspects of Satellite Communication and role of satellite in various applications.

Teaching and Assessment Scheme :

Teaching Scheme	Credits	Assessment Scheme

L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theoretical Component :

Mid Semester Evaluation [30]	Mid Semester Evaluation [10]
Mid Semester Exams	Attendance/Assignments/Presentations

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction :** The origin of satellite communications, A brief history of satellite communications, The current state of satellite communications, An overview of satellite communications.	02	7%
2	**Orbits and Launching Methods :** Introduction, Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit perturbations, Effect of non spherical earth, Atmospheric drag. Introduction of GEO orbit, Antenna look angles, Polar mount antenna, Near Geo stationary orbits, Earth Eclipse of satellite, Sun transit outage, launching orbits	05	12%
3	**Radio Wave Propagation & Polarization :** Introduction, Atmospheric losses, Ionospheric Effects, Rain attenuation, other propagation impairments. Introduction to polarization, Antenna Polarization, Polarization of Satellite signals, Cross polarization discrimination, Rain and Ice depolarization.	05	14%
4	**Space Segment :** Introduction, Spacecraft Subsystem, Attitude and orbit control system, Telemetry, tracking and command system, Power Systems, Communications subsystem, Spacecraft Antennas, Equipment reliability and space qualification.	06	12%

Unit No.	Topics	Teaching Hours	Weightage
5	**Satellite Link Design :** Basic transmission theory, System noise temperature and G/T ratio, Design of downlink, Domestic satellite systems using small earth stations, Uplink design, Design of satellite links for specified C/N.	05	12%
6	**Earth Segment :** Introduction, Receive-Only Home TV Systems, Master Antenna TV Systems, Community Antenna TV Systems, Transmit-Receive Earth Stations.	05	7%
7	**Multiple Access Techniques for Satellite Links :** Multiple Access Techniques, Frequency Division Multiple Access, Time Division Multiple Access, On Board Processing, Demand Access multiple Access, Random Access, Code Division Multiple Access.	05	12%
8	**Direct Broadcast Satellite TV and Radio :** C-Band and Ku Band Home Satellite TV, Digital DBS-TV,DBS-TV System Design, DBS-TV link Budget, Error Control in Digital DBS TV,DBS-TV Link Budget,Master Control Station and Uplink	04	7%
9	**Satellite Navigation and Global Positioning System :** Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Level, Timing Accuracy and GPS Receiver Operation	05	8%
10	**Satellite communication Case Studies :** Chandrayan 2,Chandrayan 1,Mars Orbiter Mission,LVM3-X (CARE),AstroSat, PSLV-C40/Cartosat-2 Series Satellite PSLV-C39/IRNSS-1H Mission,GSAT-17,PSLV-C38 / Cartosat-2 Series Satellite. Gslv-Mk Iii-D1 / Gsat-19, Niusat, Pisat,Pratham Sathyabamasat, Swayam	03	9%
	Total	45	100

List of References :

1. Timothy Pratt, Charles Bostian, Jeremy Allnut, "Satellite Communication", 2nd Edition , Jhon Wiley & Sons,2012
2. Dennis Roddy, "Satellite Communications",4th Edition ,McGraw Hill,2012.
3. Anil K. Maini, Varsha Agarwal, "Satellite Technology, Principles and Applications",2nd Edition, Wiley,2014.

Course Outcomes (COs):

By learning this course student will be able to …

1. Recollect basic knowledge from principles of satellite communication, orbital parameters.
2. Understand factors affecting radio wave propagation and various polarizations.
3. Study the space and ground segment of satellite communication.
4. Analyze simple Satellite Communication Link.
5. Analyze various methods for satellite access.
6. Learn various applications of satellite communication.

Course Articulation Matrix:

Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC46.1	3	2	2	1	1	1	2	2	1	3	2	2	2	2	2
3EC46.2	3	2	1	3	3	1	2	2	1	1	2	2	2	2	2
3EC46.3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
3EC46.4	3	3	3	3	3	2	1	2	2	1	3	2	2	2	2
3EC46.5	3	3	2	2	2	2	2	2	2	1	2	2	2	2	2
3EC46.6	3	2	3	3	3	3	3	2	2	2	3	3	3	3	3
AVG.	3	2.5	2.33	2.5	2.33	1.83	2	2	1.66	1.66	2.33	2.16	2.16	2.16	2.16

Delivery Methods :

1. Lectures through Blackboard/ power-point slides, videos.

2. Various case studies.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	3EC46.1	**Exams,Assignments,Presentation**
2.	3EC46.2	**Exams, Assignments, Presentation**
3.	3EC46.3	**Exams, Assignments, Presentation**
4.	3EC46.4	**Exams, Assignments, Presentation**
5.	3EC46.5	**Exams, Assignment, Presentation**
6.	3EC46.6	**Exams, Assignments, Presentation**

Distribution of Theory Marks%					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate
C: Create and above Levels (Revised Bloom's Taxonomy)
**percentage distribution may have subjected to vary slightly.

3EC83: Embedded Systems and IOT

CREDITS – 3 (L=3, T=0, P=0)

3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective:

Understand and Design Arduino based embedded systems for branch specific applications.
Understand and Integrate IoT Platforms to enhance application metrics and accessibility.

Scope : An Engineer not having basic knowledge on architecture of microcontrollers can kick-start making applications relevant to their branch or inter-branch using Arduino on completion of this course. Also can make use of IoT platforms for advance control and monitoring applications.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	*0*	*0*	*3*	*60*	*40*	*00*	*00*	*100*

Details of Assessment Instruments under CE Theory Component :

Internal Exams **[30 Mark]**	Continuous Assessment **[10 Mark]**
Mid Sem 1 & Mid Sem 2 Exam	Quiz/Presentation/Simulations

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage
1	**Introduction :** Numbering and coding systems, semiconductor memory, CPU architecture, Microcontrollers and Microprocessors, embedded system, Introduction to Arduino Uno and Arduino IDE, Structuring an Arduino Program, Using data types and operations.	4	10%
2	**IO Port Programming :** Atmega328p pins and functions, IO port programming, Using a Switch, Reading a Keypad, Visual Output, Connecting and Using LEDs, Driving a 7-Segment LED Display, LCD Display.	7	20%
3	**Serial Communication :** Introduction to serial communication, Sending Formatted Text and Numeric Data from Arduino, Sending and Receiving Serial Data in Arduino, GSM modem, Bluetooth.	7	10%
4	**Getting Input from Sensors :** Reading Analog Values, Detecting Light, Detecting Motion (Integrating Passive Infrared Detectors), Measuring Distance, Detecting Vibration, Detecting Sound, Measuring Temperature, Reading RFID Tags, Tracking Rotary Movement, Detecting Acceleration.	9	25%
5	**Physical Output :** Controlling a Servo, Driving a Brushless Motor, Controlling Solenoids and Relays, Making an Object Vibrate, Controlling the Direction and Speed of a Motor with an H-Bridge, Driving a Stepper Motor.	8	25%
6	**Introduction to IoT :** Defining IoT, Characteristics of IoT, design of IoT, Functional blocks of IoT, Communication models & APIs, IOT platforms. ESP8266- Introduction. Domain specific applications of IoT : Home automation, Industry applications, Environmental applications.	10	10%
	Total	45	100%

List of References:
Note: *List books, web resources etc ... A book should be referred in following format:*
List of Author(s), "Title of the Book", Edition number, Publisher's name, Year of Publication

1. Michael Margolis, "*Arduino Cookbook*", First Edition, O'Reilly Media, March 2011.
2. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, "*The AVR Microcontroller and Embedded Systems: Using Assembly and C*", 1st Edition, Pearson Education, 2012.
3. Michael McRoberts, "*Beginning Arduino*", Edition 2, Apress, 2013
4. Cornel Amariei, "*Arduino Development Cookbook*", Packt Publishing, 2019.
5. Michael McRoberts, "Beginning Arduino", Second Edition, Apress, 2013
6. Marco Schwartz, "*Internet of Things with ESP8266*", Packt Publishing Ltd., July 2016
7. Marco Schwartz, "*ESP8266 Internet of Things Cookbook*", Packt Publishing, 2017, ISBN: 1787288102, 978-1787288102

Suggested Specification Table with Marks (Theory) :

Distribution of Theory Marks					
R-Level	U-Level	A-Level	N-Level	E-Level	C-Level
10%	10%	30%	10%	10%	30%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Creativity above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (COs):
*(**Note:** Number of COs should be about 6. Each statement should start with an action verb. Attached herewith (in Annex-1) are example action verbs that can be used to address different levels of Bloom's taxonomy. You should prefer 3rd or higher level action verbs from this list.)*
At the end of this course students will be able to …
1. Recollect basic knowledge about Digital Systems and microcontroller architecture.
2. Understand functions of Arduino pins and illustrate its use.
3. Integrate serial communication for device interfaces and debugging in applications.
4. Make use of sensors for monitoring different quantities in application.
5. Integrate actuators in application for physical movement and control.
6. Understand concepts of IoT and design IoT applications.

Course Articulation Matrix:
Note: *Enter correlation levels 1, 2, or 3 or '-' (i.e., a dash) as defined below:*
1: *Slight (Low)* ***2:*** *Moderate (Medium)* ***3:*** *Substantial (High)* ***'-':*** *Not correlated*
The last row entry is the average of all COs for that PO/PSO. It shows the overall correlation of this course to each of the POs / PSOs.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
3EC83.1	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC83.2	3	3	3	3	2	2	2	1	1	1	1	2	3	1	3
3EC83.3	3	3	3	3	3	2	3	1	1	1	1	2	3	2	3
3EC83.4	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC83.5	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC83.6	3	3	3	3	3	3	3	1	1	1	1	2	3	2	3
3EC83	3	3	3	3	2.67	2.5	2.67	1	1	1	1	2	3	1.67	3

Delivery Methods :

Note: List all delivery methods you are going to use for this course. This may include lectures, presentation slides, discussions, visits to industries or project sites, exposure to different tools in laboratories, trainings, etc...

1. Presentations ppts
2. Simulations and videos
3. Hardware implementation
4. Discussions
5. Expert sessions

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assesment tools
1.	*3EC83.1*	Exam, Assignments, Presentation, Experiments, Project etc
2.	*3EC83.2*	Exam, Assignments, Presentation, Experiments, Project etc
3.	*3EC83.3*	Exam, Assignments, Presentation, Experiments, Project etc
4.	*3EC83.4*	Exam, Assignments, Presentation, Experiments, Project etc
5.	*3EC83.5*	Exam, Assignments, Presentation, Experiments, Project etc
6.	*3EC83.6*	Exam, Assignments, Presentation, Experiments, Project etc

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Gujarat, India

AGENDA ITEM No. 2 : EC1920.2.2

AGENDA ITEM	DESCRIPTION
EC1920.2.2	To approve the amendment in NPTEL/MOOC courses credit transfer/ exemptions (Annexure – II).

Annexure – II

With reference to CDB (Curriculum Development Board) meeting (held on 9/8/2019) and quality of NPTEL assessment, DAC (held on 21/08/2019) decided the following criteria regarding NPTEL credit transfer/exemption of subjects (Both the criteria must be fullfiled). (Refer CDB agenda - CDB.1920.1.3)

1. In a semester student will be allow to take exemption/credit transfer in **only one nptel subject .**
2. The percentage marks obtained in NPTEL exam is greater than or equal to 70 (able to map with AA or AB grade).

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AGENDA ITEM No. 3: EC1920.2.3

AGENDA ITEM	DESCRIPTION
EC1920.2.3	To approve additional Industries/Organizations for full semester (8th Semester) Industry project (Annexure – III).

Annexure – III

The Industry Project (EC 446) shall be offered as an optional subject in the 8th semester of the Respective programme and the credits of the project shall be equal to the total credits of the 8th Semester.

Approved List of Industries/Organizations by BoS :

Sr. No	Name of Industry
1	**Matrix Telecom Solutions** 19-GIDC,Waghodia Dist. Vadodara-391 760, India
2	**Aimtron Foundation** 1/A G.I.D.C. Estate, 2nd Floor ,Waghodia, Vadodara - 391760,Gujarat
3	**System Level Solutions (India) Pvt. Ltd** Plot#32, Zone-D/4, Phase-1, GIDC Estate,New V.V. Nagar - 388 121 Gujarat, India ,Anand
4	**Einfochips** Ahmedabad,Gujarat
5	**Leons' Integrations** Plot No 150,"Integration House", Ayodhyanagar,V.I.P. Road, Kareli Baugh, Vadodara, Gujarat, 390018, India
6	**Streebo Solutions Pvt. Ltd** A Floor, Siddhi Vinayak Tower, Off S.G. Highway, Makarba, Ahmedabad, India – 380051

7	**Helios Solutions** **Address** : 802 Iscon Atria 2, Gotri Road, Vadodara-390021, Gujarat **Contact Person** : Mr. Jaimin Sarvan **Website** : www.heliossolution.in **Area of Project Support for EC students**: Mobile Application Development PHP and E commerce application development.
8	**HashMedia** Contact Person: Mr. Harshit Lalpura **Website**: http://hashmedia.in/ **Area of Project Support for EC students** : Mobile Application ,PHP and E commerce application development. Biometrics Security System
9	**Indian Space Research Organisation (ISRO)** Satellite Road, Ahmedabad – 380015 **www.sac.gov.in**
10	**BISAG - Bhaskaracharya Intitute for Space Applications and Geo-informatics** Near CH '0' Circle, Indulal Yagnik Marg, Gandhinagar-Ahmedabad Highway, Gandhinagar-382 007 Gujarat, India. **bisag.gujarat.gov.in**
11	**PHYSICAL RESEARCH LABORATORY (PRL)** Navrangpura, Ahmedabad - 380 009, India
12	**INSTITUTE FOR PLASMA RESEARCH (IPR)** Bhat Village, Near Indira Bridge, Gandhinagar-382428 Gujarat - INDIA
List of Industries/Organization added and approved by BoS :	
13	**Scopo** **Address:** B/405, Titanium Heights, Opp. Vodafone house, Corporate road, Makarba, Ahmedabad – 380015 **Website**: www.scopo.in **Mobile:** +91-9724442054 **Area of Project Support for EC students** : Sensor based projects, Voice recognition system, touch switch – remote + mobile application based projects
14	**Elcop Controls** **Address :** Plot No. 2/6-A, GIDC, Narmadanagar , Opp. GNFC Corporate Office, Bharuch 392015, Gujarat, India

	Website: www.elcopcontrols.com **Mobile:** +91-9824150551 **Landline:** 02642-248883 **Area of Project Support for EC students** : Power electronics, PLC based projects, Control engineering related projects.
15	**AR Electronics** **Address :** 26/A , Safal Sumel 5, Chamunda Bridge, Chamanpura, Ahmedabad, Gujarat, India **Website:** www.arelectroworld.com **Area of Project Support for EC students :** Smart LED based street light, industrial light, smart bulb and various smart electronics based system
16	**Electrical Research and Development Association (ERDA):** **Address :** ERDA Road , GIDC, Makarpura , Vadodara - 390 010 Gujarat, India. **Website** : https://www.erda.org **Area of Project Support for students :** EMI/EMC & Energy Meter ,Transformers, switchgear , other electrical & electronics equipments , fault detection , Testing & Calibration , R & D services.
17	**Patwa Kinarivala Electrnics Ltd. :** **Address :** 2-A, Ramkrishna Chambers Productivity Road , Alkapuri , Vadodara, Gujarat 390005 **Website :** www.patwa.co.in **Area of Project Support for students** : Developing and Manufacturing Electronics Equipments related to Textile Industries. Process control equipment like Electronic Yarn Clearer along with Yarn Length Measuring and Controlling System, Yarn Evenness Tester, Yarn Fault Classifying system, Single Yarn Strength Tester etc
18	**Perfect VIPs:** **Address:** 1101 A, Wing B, Mondeal Square, Sarkhej - Gandhinagar Hwy, Prahlad Nagar, Ahmedabad, Gujarat 380015 **Website:** www.perfectvips.com **Area of Project Support for Students:** VLSI and Embedded (Verilog/ VHDL/ C/ Analog and Digital Comm./ OOP & OS on Linux/ Machine Learning, AI, OpenCV, Image Analytics)
19	**Volansys Technologies:** **Address:** Block A - 7th Floor, Safal Profitaire, Corporate Rd, Prahlad Nagar, Ahmedabad, Gujarat 380015 **Website:** https://volansys.com **Area of Project Support for Students:** Embedded Hardware
20	**Meditab Software (India) PVT LTD:** **Address:** 219/A, Kalasagar Mall, Sattadhar Cross Road Ghatlodiya, Near Sai Baba Temple, Ahmedabad, Gujarat 380061 **Website:** www.meditab.com **Area of Project Support for Students:** OOP/ Automation/ Database/ Quality Analysis/ Developer/ Technical Support
21	**Tata Consultancy Services:**

	Address: GARIMA PARK, IT/ITES SEZ, PLOT # 41, Gandhinagar -382007,Gujarat, India, Ph:- 079 61705748 **Website:** http://www.tcs.com **Area of Project Support for Students:** Assistant System Engineer-Trainee (Development, Maintenance and Support)
22	**Sruhad Technologies:** **Address:** E-102, Sharnam, Harni-Motnath Road, Vadodara 390022 (Gujrat India) **Website:** www.sruhadtech.com **Area of Project Support for Students:** Embedded System Design, IoT Solution, Industrial Automation
23	**Pratap Technocrats PVT LTD:** **Address:** Ramdev Nagar, Ahmedabad, Gujarat 380015 **Website:** https://www.pratap.co.in **Area of Project Support for Students:** Optical Fibre Cable Networks, Telecom installation, Solar segment
24	**Shree Kamdhenu Electronics PVT LTD:** **Address:** "Akashganga", 102, Shivam Complex, Nana Bazar, Vidya Nagar - 388120 District: ANAND, Gujarat - INDIA. **Website:** http://www.akashganga.in **Area of Project Support for Students:** Electronics Communication, Embedded System, Dairy automation
25	**Zenn Systems PVT LTD:** **Address:** 25, Shakuntal Shopping Centre, V S Road, Ambavadi, Ahmedabad, Gujarat 380006 **Website:** http://www.zennsystems.com **Area of Project Support for Students:** Robotics and automation

Chairman, I/C BoS
Dr. B. C. Goradiya

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Board of studies Meeting

Annexure – IV

Brila Vishvakarma Mahavidyalaya Engineering College
(An Autonomous Institution)
Electronics & Communication Department

Meeting of Board of Studies for Electronics & Communication Engineering Program

Date: 21/12/2019

Members of Board of Studies

Sr. No.	Name of Member	Designation	Role in BoS	Sign
		Faculty Members of EC Department		
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	Chairman	
2	Prof. K. R. Patel	Asst. Professor, EC, BVM	Secretary	
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member	
4	Dr. D. C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member	
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member	
6	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member	
7	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member	
8	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member	
9	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member	
10	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	Faculty Member	
11	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member	
12	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member	
13	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member	
14	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member	
		External Experts		
1	Prof. Usha Nilkanthan	Head & Professor, LD College	VC Nominee	
2	Dr. Mehul Raval	Professor, PDPU, Gandhinagar	Expert in the subject (Outside College)	
3	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips, Ahmedabad	Representative from Industry	
4	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)	
5	Er. Meet Shah	Sr. DevOps Engineer, Einfochips, Ahmedabad	Post Graduate Alumnus	

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Board of Studies (BoS) meeting of B. Tech Electronics and Communication Engineering Programme, BVM (Under Autonomous scheme), was held on 12 - 09 – 2020 online through Google Meet from 10:45 AM to 1:45 pm to discuss the following agenda items:

Agenda of the Meeting

EC2021.1.1	To Discuss, Suggest, and Approve the detailed syllabus of the **Fourth Level** of UG Programme (2018-19 Cycle) as per the New AICTE / UG Model Curriculum Guideline. (Annexure – I).
EC2021.1.2	To Discuss and Suggest the list of **Minor Degree** (Electronics and Communication Engineering) Courses. (Annexure-II).
EC2021.1.3	To approve the amendments made in the teaching and assessment scheme of the following three subjects of the **Third Level**. • 3EC81: Introduction to Cellular Communication • 3EC82: Applied Electronics • 3EC83: Embedded Systems and IoT (Annexure-III).

Following BoS, EC members were present in the meeting:

Sr. No.	Name of Member	Designation	Role in BoS
Faculty Members of the EC Department			
1	Dr. B. C. Goradiya	Professor & Head, EC, BVM	**Chairman**
2	Dr. S. R. Unadkat	Asst. Professor, EC, BVM	BoS Secretary
3	Dr. R. C. Rana	Asso. Professor, EC, BVM	Faculty Member
4	Dr. D.C. Dalwadi	Asso. Professor, EC, BVM	Faculty Member
5	Prof. A. B. Bambhaniya	Asst. Professor, EC, BVM	Faculty Member
6	Prof. H. J. Patel	Asst. Professor, EC, BVM	Faculty Member
7	Prof. R. P. Paul	Asst. Professor, EC, BVM	Faculty Member
8	Prof. G. B. Rathod	Asst. Professor, EC, BVM	Faculty Member
9	Prof. A. A. Vahora	Asst. Professor, EC, BVM	Faculty Member
10	Prof. A. H. Choksi	Asst. Professor, EC, BVM	Faculty Member
11	Prof. R. R. Vashi	Asst. Professor, EC, BVM	Faculty Member
12	Prof. K. R. Patel	Asst. Professor, EC, BVM	Faculty Member
13	Prof. M. M. Sevak	Asst. Professor, EC, BVM	Faculty Member

External Experts			
1	Er. Nilesh Ranpura	Device Manager (ASIC), Einfochips, Ahmedabad	Representative from Industry
2	Er. Krunal Patel	Project Manager, SLS	Expert in the subject (Outside College)

Following BoS, EC members were absent in the meeting:

Sr. No.	Name of Member	Designation	Role in BoS
Faculty Members of the EC Department			
1	Prof. P. K. Patel	Asst. Professor, EC, BVM	Faculty Member
External Experts			
1	Dr. Mehul Raval	Professor, PDPU, Gandhinagar	Expert in the subject (Outside College)
2	Er. Bhargav Ravat	Research and Development Manager, Ahmedabad	Postgraduate meritorious alumnus

One of the External BOS Expert could not attend the online meeting due to his prior comments and have sent the suggestions through email

Sr. No.	Name of Member	Designation	Role in BoS
External Experts			
1	Dr. Mehul Raval	Professor, PDPU, Gandhinagar	Expert in the subject (Outside College)

The following suggestions and decisions were made confidentially with regards to the Agenda of the meeting after detailed discussions in the meeting:

Agenda: 01

In the beginning Dr. Bhargav Goradiya, Head E. C. Department welcomed all the external Board of Studies members and all the faculty members. HOD sir also shared the achievements and innovative practices of faculties as well as students.

The following color codes are used to indicate, as well as to bifurcate the changes made in the syllabus.

***Interpretation of colors*:**

Black: No change in the content

Blue: Moderate Change in the content

Green: For a completely new content

4EC01: Computer Networks

- The case study can be shifted to the laboratory part.
- A book by William Stallings should be included in the reference book list.
- Try to teach error-correcting codes.
- Information theory is missing.
- The computer networks subject is appearing late by one semester. Ideally should have been covered by the sixth semester. A unit on Wireless sensor networks can be an added advantage to the content.

4EC02: Computer Networks Laboratory

- The title of the practical no 2 should be changed.
- Instead of full-duplex communication, highlight the data transfer between two links.
- C-code is not necessary to be written in the title.
- Experiment titles should be more objective.
- Specify the no. of an experiment in CISCO packet tracer as there are many.
- IPV6 should be added to the practical title.
- Computer Network labs must incorporate experimentation on the security of the network.

4EC03: Wireless Communication

- RF and Microwave engineering should be taught before wireless communication subjects.
- The wireless communication course is more like a Mobile Computing course. The content needs to be more progressive. We need to introduce 5G networks, Spectrum sensing concepts, cognitive radio-related concepts.

4EC04: Wireless Communication Laboratory

- The software-defined video should be covered
- Avoid introduction to Matlab title and give a suitable title.
- Remove the Matlab word from every practical title.
- In experiment 3 remove the term GSM phone.

4EC05: Embedded System Design with IoT

- In chapter 3 incorporate open source Hardware and Software platforms instead of particular hardware names.
- We may review the title "Embedded System Design with IOT" The fusion of these two names does not appear homogeneous to me. It can be just the Internet of Things. Can we think of a broader course e.g., Industry 4.0 in the place?

4EC06: Embedded System Design with IoT laboratory

- Instead of writing ESP8266 write wi-fi enabled IoT device.
- The title of practical 2 should be generalized.

4EC07: Electronics Product Design

- **Inputs will be sent by email (Er. Krunal Patel)**
- Electronic Product design according to me has a very narrow perspective. Instead, incorporate courses like design thinking and let students develop solutions using any engineering discipline.

4EC08: Guided Research

- Teaching this subject at the UG level is not necessary.
- Slightly different content is required to be offered.
- Research tools can be taught on this subject.
- The latest and advanced information needs to be provided to the students.
- Make the subject more lab oriented.
- A suitable too is needed to be identified for a whole semester.
- Guided research courses in a stand-alone mode is not an attractive proposition. These types of exercises should be done through regular courses in Sem VI onwards. Replace its course on "Passion Pursuit" and give students a choice to follow what they want to do. It can be done with an evaluation.

Program Elective - III

4EC41: Digital Image Processing

- Try to incorporate the experiments where students can use the hardware background for image processing.
- The Course on Image Processing has very heavy content. I suggest removing Unit 4 and Unit 8 in theory. Let these units be covered through Labs.

4EC42: Bio-Medical Instrumentation

- Regulation details should also be included to understand the standard of biomedical products.

- Biomedical instrumentation: There has to be a unit on Signal processing for biomedical signals. Even introduce some image processing for biomedical images.

4EC43: RF and Microwave Engineering

- Silicon photonics should be added to the syllabus.
- Why RF and Microwave is a redundant elective. I think it should be replaced with some interesting offerings like Machine Learning. Bring it up from Sem VIII elective list.

Semester 8 [Scheme - A]

4EC31: project

- Approved

Program Elective - IV

4EC44: Radar & Navigational Aids

- Approved

4EC45: Machine Learning

- Approved

4EC46: Advance Communication System

- Approved

Program Elective – V

4EC47: Virtual Instrumentation

Approved

4EC48: Device driver Development

- Some of the experiments are OS based so try to include device driver based experiments.

4EC49: Android Programming

- Proprietary titles should be avoided.
- Don't restrict technology to one programming system only.

Agenda: 02

Dr. B. C. Goradiya explained the agenda 2 in brief to all the BoS members.

- Members will provide their suggestions by email.

- I think 6 courses will be shortlisted for providing the minor. They could be Electronic Devices and Circuits, Digital Logic Design, Signals and Systems, Analog and Digital Communication, Computer Networks, Microprocessor and Interfacing

Agenda: 03

- Dr. B. C. Goradiya also discussed the amendments made in the 3rd year subjects.

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AGENDA ITEM No. 1: EC2021.1.1

AGENDA ITEM	DESCRIPTION
EC2021.1.1	To Discuss, Suggest, and Approve the detailed syllabus of the **Fourth Level** of UG Programme (2018-19 Cycle) as per the New AICTE / UG Model Curriculum Guideline. (Annexure – I).

The following syllabus is the updated syllabus containing the suggestions and changes indicated by the BoS members
The following color codes are used to indicate, as well as to bifurcate the changes made in the syllabus in comparison with the old structure syllabus.

***Interpretation of colors*:**

Black: No change in the content

Blue: Moderate Change in the content

Green: For a completely new content

Annexure-I

Teaching Structure of 4th Level B.Tech (Electronics and Communication Programme) under BVM Autonomous Scheme w.e.f. Academic Year 2020 - 2021 for 2018-19 Batch. (Proposed and Approved in BoS Meeting of September 2020).

Electronics and Communication Engineering Department
Course Structure (Academic Year 2020-2021)

Semester – VII

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	4EC01	Computer Networks	3	0	0	3	3
2.	4EC02	Computer Networks Laboratory	0	0	2	2	1
3.	4EC03	Wireless Communication	3	0	0	3	3
4.	4EC04	Wireless Communication Laboratory	0	0	2	2	1
5.	4EC05	Embedded System Design with IOT	3	0	0	3	3
6.	4EC06	Embedded System Design with IOT Laboratory	0	0	2	2	1
7.	4EC07	Electronic Product Design	0	0	2	2	1
8.	4EC08	Guided Research	0	0	4	4	2
		Programme Elective – III	3	0	2	5	4
9.	4EC41	Digital Image Processing					

10.	4EC42	Bio Medical Instrumentation					
11.	4EC43	RF and Microwave Engineering					
		Total	**12**	**0**	**14**	**26**	**19**

Semester – VIII

Sr. No	Course Code	Name of Course	L	T	P	H	C
1.	4EC31	Project	0	0	18	18	9
		Programme Elective – IV	3	0	2	5	4
2.	4EC44	Radar & Navigational Aids					
3.	4EC45	Machine Learning					
4.	4EC46	Advance Communication Systems					
		Programme Elective – V	1	0	2	3	2
5.	4EC47	Virtual Instrumentation					
6.	4EC48	Device Driver Development					
7.	4EC49	Android Programming					
		Total	**4**	**0**	**22**	**26**	**15**
OR							
		Semester – VIII	**L**	**T**	**P**	**H**	**C**
1.	4EC32	Industry Project	0	0	30	30	15

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4EC01: Computer Networks
Credits - 3 (L=3, T=0, P=0)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

Understand detailed functionality and Demonstrate knowledge of layered computer network architecture with their protocol and application.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component

Internal Exams [30 Marks]	Continuous Assessment/ALA* [10 Marks]
Mid Sem Internal Exams	Attendance /Assignments / Quiz

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Basics of Networking**: Introduction – Uses – Network Hardware – LAN –MAN – WAN, Network Software – Protocol hierarchies. Reference models – OSI – TCP/IP – Design issues for the layers – Interface & Service – Service Primitives	08	16%
2	**Functionalities of Data link layer** : Introduction, Framing, Error Detection, and Correction – Parity – LRC – CRC- Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels- Stop and wait – ARQ – Sliding window, HDLC, PPP. Random access, Controlled access, Channelization, Collision Free Protocols, Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11	10	24%
3	**Network Layer :** IPv4 Datagram approach – IP addressing methods – Subnetting CIDR –Internetworking – Routing Techniques: Distance vector (RIP) – Link-state (OSPF) - BGP - IPv6 –Case Studies	10	24%

4	**Transport Layer:** Connection Oriented and Connectionless Protocols - Process to Process Delivery, UDP and TCP protocols, Congestion Control - Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.	08	16%
5	**Application layer:** DNS - Domain name space, DNS in internet, Electronic mail Protocols and Network Security - FTP, WWW, HTTP, SNMP, Network Security, Cryptography.	08	16%
	Total	45	100 %

Reference Books :

1. Behrouz A. Forouzan, "*Data Communications and Networking*", 4th Edition, TMH, 2006.
2. Andrew S Tanenbaum, "*Computer Networks*", 4th Edition, Pearson Education/PHI.
3. Data and Computer Communications, 8th Edition., William Stallings, Prentice Hall, 2006.
4. P.C .Gupta, "*Data communications and computer Networks*", PHI.
5. S.Keshav, "*An Engineering Approach to Computer Networks*", 2nd Edition, Pearson Education.
6. W.A. Shay, "*Understanding communications and Networks*", 3rd Edition, Cengage Learning.
7. James F. Kurose & Keith W. Ross, "*Computer Networking: A Top-Down Approach Featuring the Internet*", 3rd Edition, Pearson Education.

Course Outcomes (COs) :

By learning this course students will be able to.....

1. To visualize the different aspects of networks, protocols and network design models.
2. To examine various Data Link layer design issues and Data Link protocols.
3. To analyze and compare different LAN protocols.
4. To compare and select appropriate routing algorithms for a network.
5. To examine the important aspects and functions of network layer, transport layer and application layer in internetworking.
6. Analyze different protocols of Application Layer and various security risks.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC01.1	1	2	-	3	-	-	-	-	-	-	-	-	3	-	2
4EC01.2	-	1	-	2	-	-	-	-	-	-	-	-	3	-	1
4EC01.3	-	-	1	2	-	-	-	-	-	-	-	-	3	-	1
4EC01.4	-	1	-	2	3	-	-	-	-	-	-	-	3	-	2
4EC01.5	1	1	-	2	-	-	-	-	-	-	-	-	3	1	2
4EC01.6	1	1	-	2	2	-	-	-	-	-	-	-	3	1	2
Average	0.5	1	0.16	2.16	0.83	-	-	-	-	-	-	-	3	0.33	1.66

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Case studies

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC01.1	**Exam, Assignments, Presentation etc**
2.	4EC01.2	**Exam, Assignments, Presentation etc**
3.	4EC01.3	**Exam, Assignments, Presentation etc**
4.	4EC01.4	**Exam, Assignments, Presentation etc**
5.	4EC01.5	**Exam, Assignments, Presentation etc**
6.	4EC01.6	**Exam, Assignments, Presentation etc**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

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4EC02: Computer Networks Laboratory
CREDITS – 1 (L=0, T=0, P=2)
4th Year, B. Tech. (Electronics and Communication)

Course Objective:

To use simulation tools to analyze the performance of various network protocols.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 marks)

60-mark distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Project/OEP	Total
20	10	10	20	60

List of Experiments:

At least 10 experiments based on available software and hardware

Sr. No	Aim
1	Introduction to RS232 communication & BIOSCOM function.
2	Implementation of code for data transfer between two PCs.
3	Introduction to CISCO Packet tracer.
4	To study about different network command.
5	To study about IPv4 and IPv6 addressing and subnet.
6	To study about Ping and ARP packets and simulation in CISCO packet tracer.
7	To study Virtual LAN and simulate in CISCO packet tracer.
8	Implement Static routing using CISCO packet tracer.
9	Implement routing information protocol in CISCO packet tracer.
10	To study about Wireshark software.

Lab Resources:

HARDWARE: 1. Standalone desktops 20 Nos
SOFTWARE: C Compiler, Network simulator Cisco Packet Tracer, Wireshark

List of References:

1. Behrouz A. Forouzan, "*Data Communications and Networking*", 4th Edition, TMH, 2006.
2. Andrew S Tanenbaum, "*Computer Networks*", 4th Edition, Pearson Education/PHI.
3. P.C .Gupta, "*Data communications and computer Networks*", PHI.
4. S.Keshav, "*An Engineering Approach to Computer Networks*", 2nd Edition, Pearson Education.
5. W.A. Shay, "*Understanding communications and Networks*", 3rd Edition, Cengage Learning.
6. James F.Kurose & Keith W. Ross, "*Computer Networking: A Top-Down Approach Featuring the Internet*", 3rd Edition, Pearson Education.

Course Outcomes (COs):

By learning this course students will be able to

1. Demonstrate various networking devices to design a network
2. Examine various routing algorithms for reliable data communication networks
3. Categorize the algorithms for data link layer
4. Analyze the communication parameters of routing algorithms
5. To learn and use network commands.
6. To use simulation tools to analyze the performance of various network protocols.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC02.1	1	2	-	3	-	-	-	-	-	-	-	-	3	-	2
4EC02.2	-	1	-	2	-	-	-	-	-	-	-	-	3	-	1
4EC02.3	-	-	1	2	-	-	-	-	-	-	-	-	3	-	1
4EC02.4	-	1	-	2	3	-	-	-	-	-	-	-	3	-	2
4EC02.5	1	1	-	2	-	-	-	-	-	-	-	-	3	1	2
4EC02.6	1	1	-	2	2	-	-	-	-	-	-	-	3	1	2
Average	0.5	1	0.167	2.167	0.83	0	0	0	0	0	0	0	3	0.33	1.67

Delivery Methods:

7. HARDWARE: 1. Standalone desktops 20 Nos
8. SOFTWARE: C Compiler, Network simulator Cisco Packet Tracer, Wireshark

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC02.1	**File, Exams, Experiments, Project/OEP**
2.	4EC02.2	**File, Exams, Experiments, Project/OEP**
3.	4EC02.3	**File, Exams, Experiments, Project/OEP**
4.	4EC02.4	**File, Exams, Experiments, Project/OEP**
5.	4EC02.5	**File, Exams, Experiments, Project/OEP**
6.	4EC02.6	**File, Exams, Experiments, Project/OEP**

OEP (Open Ended Problem):

1. Router installation and study of specifications and Router configuration of campus/institute
2. Prepare the presentation and report on different network.
3. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer. a. Link State routing b. Flooding c. Distance vector

4EC03: Wireless Communication
Credits - 3 (L=3, T=0, P=0)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To understand concept of wireless communication systems and networks, cellular fundamentals, mobile radio propagation models, multiple access techniques and recent emerging trends.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component

Internal Exams[30 Marks]	Continuous Assessment /Open Ended Program[10 Marks]
Mid Sem Internal Exams	Attendance/Assignments /Quiz

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Wireless Communication Systems and Networks:** Evolution of mobile communications, Mobile Radio System around the world, Examples of Wireless communication Systems, 2G Cellular Networks, 3G Wireless Networks, 4G Wireless Networks, Wireless local loop (WLL), Wireless local area network (WLAN), Bluetooth and Personal Area Networks.	05	15%
2	**Cellular Concept and its fundamentals:** Cellular system, Concept of frequency reuse, Channel Assignment Strategies, Handoff Strategies, Soft Handoff, Hard Handoff, Umbrella Cell Concept, Co-channel interference and system capacity, Adjacent channel interference, Trunking and GOS, Improving Coverage & Capacity in Cellular System- Cell splitting, Cell	08	20%

	sectoring, Repeaters, Micro cell zone concept, Case study on Hand off.		
3	**Mobile Radio Propagation Model: Large-Scale Path Loss and Small-Scale Fading :** Introduction to Radio wave propagation, Free Space Propagation model, three basic propagation mechanisms, Reflection, Two ray ground reflection model, Diffraction, Fresnel zone geometry, Knife-edge diffraction model, Scattering, Outdoor propagation models, Indoor propagation models, Small scale multipath propagation, Impulse response model for multipath channel, Parameters of mobile multipath channels, Types of small scale Fading, Rayleigh and Ricean distributions.	10	20%
4	**Diversity and Multiple Access Techniques:** Introduction to diversity and its types, Selection diversity, Feedback diversity, Maximal ratio combining technique, Equal gain combining technique, Types of Multiple Access techniques - FDMA, TDMA and CDMA,Case study of how diversity is addressed in a multi-national organization.	09	15%
5	**Wireless Systems:** GSM system architecture, CDMA system architecture, Long Term Evolution Technologies (LTE)-OFDM, MIMO channels, Space Time Codes.	09	15%
6	**Recent emerging trends of wireless communication:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network, Case study about SDR and security in cellular communication.	05	15%
	Total	45	100 %

Reference Books:

1. T. S. Rappaport, *"Wireless Communications – Principles and Practice"*, Pearson Education, 2nd Edition, 2012.
2. T. L. Singal, *"Wireless Communications"*, McGraw Hill Education Private Limited, 2nd Edition, 2011.
3. A. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
4. W.C.Y.Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecomm. 2nd Edition, 1998.

Course Outcomes (COs):

By learning this course students will be able to

1. Understand the wireless communication systems and its standards.
2. Design the base station with respect to co-channel cells &adjacent channel cells concept.
3. Analyze and design the various indoor and outdoor mobile radio propagation model.
4. Understand and Compare the multiple access technologies in wireless communication.
5. Evaluate and design the GSM and CDMA wireless networks.
6. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC03.1	2	2	1	1	0	0	1	0	0	1	1	1	2	1	2
4EC03.2	3	3	2	3	2	0	1	0	0	2	1	2	3	3	3
4EC03.3	3	3	2	3	3	0	1	0	0	2	1	2	3	3	3
4EC03.4	3	3	1	3	3	0	1	0	0	1	1	1	3	3	3
4EC03.5	2	2	2	1	2	0	1	0	0	2	1	2	3	2	3
4EC03.6	2	2	2	1	1	0	1	0	0	2	1	2	3	3	2
Average	2.5	2.5	1.6	2.0	1.83	0	1	0	0	1.6	1	1.6	2.8	2.5	2.6

Delivery Methods:

1. Lectures through Blackboard and power-point slides.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC03.1	**Exam, Assignments, Presentation**
2.	4EC03.2	**Exam, Assignments, Presentation**
3.	4EC03.3	**Exam, Assignments, Presentation**
4.	4EC03.4	**Exam, Assignments, Presentation**
5.	4EC03.5	**Exam, Assignments, Presentation**
6.	4EC03.6	**Exam, Assignments, Presentation**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	15	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Open Ended Problem:

1. Design of Any Arbitrary Modulation Scheme –8PSK, QAM (16, 64 etc), EDGE, WCDMA*, WiFi*, WiMAX* –Compare at base-band, IF and RF.
2. Design of Discrete Multi-tone modem, FM Radio Reception.
3. Design/implement the different Channel Coder/Decoder –Turbo decoder –LDPC coder / decoder.
4. Project based on Reception of local GSM broadcast channel.
5. Project based on Frequency Hopping Spread Spectrum (FHSS).

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4EC04: Wireless Communication Laboratory
CREDITS – 1 (L=0, T=0, P=2)
4th Year, B. Tech. (Electronics and Communication)

Course Objective:

To understand concept of wireless communication systems and networks, cellular fundamentals, mobile radio propagation models, multiple access techniques and recent emerging trends.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 mark)

File	Viva	Attendance	Project	Total
10	20	10	20	60

List of Experiments:

Sr. No	Aim
1	Study of simulation tool.
2	Study Random data generation and calculating bit error rate in it.
3	Find the effect of different Duty cycle and transmit time to see the wide range of battery life time.
4	To find blocking probability using Erlang B-Formula.
5	To find probability of call being delayed using Erlang C-Formula.
6	To study reflection co-efficient for parallel and perpendicular electric field component.
7	To find path loss using Okumura model.
8	To find path loss using Hata model.
9	To study about ASK, PSK, and FSK Technique in Wireless Communication.
10	Simulate AWGN and multipath fading environment in Simulation Tool.

Experiments based on GSM (Using Wireless Communication Trainer)

- Study the implementation of GMSK modulation, OQPSK detection.
- Observe phase response of Tx and Rx and Spectrum of Tx and Rx.
- Measure the BER value – GSM AT Commands

Lab Resources:

- Simulation Tool
- kits

List of References:

1. T. S. Rappaport, *"Wireless Communications – Principles and Practice"*, Pearson Education, 2nd Edition, 2012.
2. T. L. Singal, *"Wireless Communications"*, McGraw Hill Education Private Limited, 2nd Edition, 2011.
3. A. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
4. W.C.Y.Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecomm. 2nd Edition, 1998.

Course Outcomes (COs):

By learning this course students will be able to.....

1. Understand the wireless communication systems and its standards.
2. Design the base station with respect to co-channel cells &adjacent channel cells concept.
3. Analyse and design the various indoor and outdoor mobile radio propagation model.
4. Understand and Compare the multiple access technologies in wireless communication.
5. Evaluate and design the GSM and CDMA wireless networks.
6. Compare the recent emerging protocol of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC04.1	2	2	1	1	0	0	1	0	0	1	1	1	2	1	2
4EC04.2	3	3	2	3	2	0	1	0	0	2	1	2	3	3	3
4EC04.3	3	3	2	3	3	0	1	0	0	2	1	2	3	3	3
4EC04.4	3	3	1	3	3	0	1	0	0	1	1	1	3	3	3
4EC04.5	2	2	2	1	2	0	1	0	0	2	1	2	3	2	3
4EC04.6	2	2	2	1	1	0	1	0	0	2	1	2	3	3	2
Average	2.5	2.5	1.6	2.0	1.83	0	1	0	0	1.6	1	1.6	2.8	2.5	2.6

Delivery Methods:

1. Blackboard
2. Presentation slides
3. Visit

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC04.1	**Exam**
2.	4EC04.2	**Exam**
3.	4EC04.3	**Exam**
4.	4EC04.4	**Exam**
5.	4EC04.5	**Exam**
6.	4EC04.6	**Exam**

4EC05: Embedded System Design with IOT
Credits - 3 (L=3, T=0, P=0)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

Introduce concepts of IOT and its applications for designing and developing embedded system with integration of IOT for real time applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Details of Assessment Instruments under CE Theory Component

Internal Exams [30 Marks]	Continuous Assessment /ALA* [10 Marks]
Mid Sem Internal Exams	Attendance /Assignments / Quiz/OEP

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction to Embedded System:** Introduction to embedded systems, Application domains, features and characteristics, MCU vs MPU, Figures of Merit of embedded system, Classification of MCUs, Current trends. Software development tools: ICP, ISP, emulators, simulators. Real time operating system, Hardware software co-design concepts, Embedded Product development.	09	10%
2	**Introduction to IOT:** Internet of things, IOT conceptual framework and architecture, Technology behind IOT, Applications. M2M communication. Design Principles: communication technologies, data and device management. Design principles of web connectivity: Web communication protocols, message communication protocols- MQTT, XMP; Web connectivity – REST, websocket.	08	10%

3	**IoT Platform overview:** Overview of IoT supported Hardware platforms based on 8-bit MCUs, ARM processor and other wifi enabled boards. Prototyping and designing the software for IOT applications, APIs and web APIs. Open source platforms.	10	20%
4	**Designing IOT based Systems:** Overview of Sensors and Actuators, participatory sensing, industrial IoT, Automotive IoT, smart home IOT, IOT integration with embedded platform.	08	30%
5	**IoT and Cloud Integration:** Data collection, storage and computing using cloud: cloud computing paradigm, Cloud service model, Thingspeak and Blynk concepts and applications.	05	20%
6	**Case Study & advanced IoT Applications:** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)	05	20%
	Total	45	100 %

Reference Books :

1. Das, LyLa B. "*Embedded Systems: An Integrated Approach*". India, Pearson Education India, 2012.
2. Raj Kamal. *"Internet of Things"*. McGraw-Hill Education, 2017
3. Elk, Klaus. "*Embedded Software for the IoT*. Walter de Gruyter GmbH & Co KG, 2018.
4. Xiao, Perry. *"Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed"*. United Kingdom, Wiley, 2018.
5. *"Embedded Systems - SoC, IoT, AI and Real-Time Systems*" 4th Edition. N.p., McGraw-Hill Education, 2020.
6. Schwartz, Marco. "*Internet of Things with ESP8266*". United Kingdom, Packt Publishing, 2016.
7. Schwartz, Marco. "*ESP8266 Internet of Things Cookbook*". United Kingdom, Packt Publishing, 2017.
8. Miller, Michael. *"The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World"*. N.p., Pearson Education, 2015.

Course Outcomes (COs) :

By learning this course students will be able to:

1. Understand and recollect concepts of Embedded systems and its features, characteristics and figure of merits.

2. Understand the concept of IOT and its architecture.
3. Analyze the application requirement for selection of appropriate platform
4. Design and develop an IOT application.
5. Integrate cloud with IOT application.
6. Understand application and its requirements for developing solution.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC05.1	3	3	3	3	3	1	2	-	1	-	1	1	2	2	3
4EC05.2	3	2	2	2	2	2	2	2	1	2	1	1	1	1	3
4EC05.3	3	3	3	3	3	1	-	-	1	-	1	1	3	2	3
4EC05.4	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
4EC05.5	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
4EC05.6	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
Average	3.0	2.8	2.8	2.8	2.8	2.2	2.0	2.0	1.0	1.3	1.0	1.5	2.5	2.3	3.0

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Simulations of applications in parts/partial.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	4EC05.1	**Exam, Assignments, Presentation, Experiments, Project etc**
2.	4EC05.2	**Exam, Assignments, Presentation, Experiments, Project etc**
3.	4EC05.3	**Exam, Assignments, Presentation, Experiments, Project etc**
4.	4EC05.4	**Exam, Assignments, Presentation, Experiments, Project etc**
5.	4EC05.5	**Exam, Assignments, Presentation, Experiments, Project etc**
6.	4EC05.6	**Exam, Assignments, Presentation, Experiments, Project etc**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	10	10	20

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

4EC06: Embedded System Design with IOT Laboratory
Credits – 1 (L=0, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

Study and learn the concept of IOT applications and implement the embedded system with IOT integration.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 marks)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

60-mark distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Project/OEP	Total
10	10	10	30	60

List of Experiments:

Sr. No	Aim
1	Introduction to embedded boards and its features
2	On-off control through cloud dashboard
3	Input-output device remote controlling using Wi-Fi/Bluetooth/Xee Bee/RF.
4	Web server creation and data posting using Wi-Fi enabled board.
5	Sending Notifications using Wi-Fi enabled board.
6	Ethernet Web Client and Web Server
7	Sensor Data dashboard creations
8	Cloud Data Logging
9	Posting temperature and humidity data on cloud/server.

10	Building a light-activated relay with M2M.
11	Controlling a Door Lock from the Cloud.
12	Wireless Gardening with IOT
13	Cloud-Based Home Automation System
14	Cloud-Controlled Robot
15	Cloud machine to machine interaction (MQTT)

Lab Resources:

- MCU/MPU kit: ARM mbed, Raspberry pi, Beagle Bone, ESP8266, Arduino, Wifi module, other open source IOT platforms.
- Keil IDE, Arduino IDE, Eclipse IDE
- Proteus Software
- Internet connectivity

List of References:

1. Das, LyLa B. "*Embedded Systems: An Integrated Approach*". India, Pearson Education India, 2012.
2. Raj Kamal. "*Internet of Things*". McGraw-Hill Education, 2017
3. Elk, Klaus. "*Embedded Software for the IoT*. Walter de Gruyter GmbH & Co KG, 2018.
4. Xiao, Perry. "*Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed*". United Kingdom, Wiley, 2018.
5. "*Embedded Systems - SoC, IoT, AI and Real-Time Systems*" 4th Edition. N.p., McGraw-Hill Education, 2020.
6. Schwartz, Marco. "*Internet of Things with ESP8266*". United Kingdom, Packt Publishing, 2016.
7. Schwartz, Marco. "*ESP8266 Internet of Things Cookbook*". United Kingdom, Packt Publishing, 2017.
8. Miller, Michael. "*The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World*". N.p., Pearson Education, 2015.

Course Outcomes (COs):

By learning this course students will be able to:

1. Understand and recollect concepts of Embedded Systems and its features, characteristics and figure of merits.
2. Understand the concept of IOT and its architecture.
3. Analyze the application requirement for selection of appropriate platform
4. Design and develop an IOT application.
5. Integrate cloud with IOT application.
6. Understand application and its requirements for developing solution.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC05.1	3	3	3	3	3	1	2	-	1	-	1	1	2	2	3
4EC05.2	3	2	2	2	2	2	2	2	1	2	1	1	1	1	3
4EC05.3	3	3	3	3	3	1	-	-	1	-	1	1	3	2	3
4EC05.4	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
4EC05.5	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
4EC05.6	3	3	3	3	3	3	2	2	1	1	1	2	3	3	3
Average	3.0	2.8	2.8	2.8	2.8	2.2	2.0	2.0	1.0	1.3	1.0	1.5	2.5	2.3	3.0

Delivery Methods:

1. Keil programming
2. Arduino IDE
3. Eclipse IDE
4. Proteus Simulations
5. Hardware interfacing with sensor and actuators

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC06.1	**Viva, Practical performance, projects, assignments, etc.**
2.	4EC06.2	**Viva, Practical performance, projects, assignments, etc.**
3.	4EC06.3	**Viva, Practical performance, projects, assignments, etc.**
4.	4EC06.4	**Viva, Practical performance, projects, assignments, etc.**
5.	4EC06.5	**Viva, Practical performance, projects, assignments, etc.**
6.	4EC06.6	**Viva, Practical performance, projects, assignments, etc.**

4EC07: Electronic Product Design
CREDITS – 1 (L=0, T=0, P=2)
4th Year, B. Tech. (Electronics and Communication)

Course Objective:

The primary objective of this course is to understand the steps and process of the electronics product design. Learning the integration of electronics product design and development from the industry experts.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
0	0	2	1	0	0	40	60	100

Details of Assessment Instruments under CE Practical Component: (60 mark)

60-mark distribution (Internal Continuous Evaluation)

Report	ALA	Attendance	E-content/OEP	Total
20	15	15	10	60

List of Product design modules: Each module may comprises around 4 hours of expert interaction preferably from industry. Majority of the areas covered for electronics product design are: **Analog system design, Digital system design, Embedded, VLSI system design, Communication systems.**

Course Contents:

Unit No	Aim
1	**Stages in Product Design Overview:** Market Survey, Product Specification, R & D and prototype development, Pilot production, Testing & Verification, documentation and Manufacturing.
2	**Classification of Electronic Product:** Consumer product, Industry product, Defense product
3	**Hardware Design:** Analog and Digital hardware design; Analog signal conditioning, Factors affecting choice of analog devices and digital microcontrollers, ADCs, DACs, DAS (Data Acquisition System), Data logger, Selection of the Bus and Protocol (I2C, SPI, IEEE Standards etc.)

4	**Programming:** Choosing a language of programming; Debugging tools and techniques, usage of Simulators, Emulators and Assemblers.
5	**Testing and verification:** Software testing and Evaluation; Hardware test programs.
6	**PCB design:** PCB layout, Ground planes, Power planes, Analog run and Digital run, Component mounting, routing signal trace, study of IC packages

Lab Resources:

- Experts from Industry.
- Industry visits.
- Existing setup of various laboratories, ELARC and Center of Excellence.

List of References:

1. V.S. Bagad *"Electronic Product Design a conceptual approach"*, Technical publication, First Edition, Reprint 2019.
2. V.B. Baru, R.G. Kaduskar, "*Electronic Product Design*", Wiley India, 2nd Edition, Year.
3. Bert Haskell *"Portable Electronics Product Design and Development"*, Mcgraw hill Publication, 2004.
4. Page Tom, *"Electronic Product Design: A Case Study in Cellular Device Design"*, LAP Lambert Academic Publishing, 2013.
5. S. D. Mehta, *"Electronic Product Design Volume-1"*, S. Chand Publishing, 2011.

Course Outcomes (COs):

By learning this course students will be able to…

1. Understand various stages of Electronic Product Design.
2. Apply the knowledge of Analog and Digital Hardware for the Designing product.
3. Understand the concept of consumer product, industry product and defense product.
4. Analyze the need of the product and select appropriate programming language.
5. Understand the importance of testing and verification of the product.
6. Evaluate the layout design of the PCB.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC07.1	3	3	3	1	2	2	2	1	2	1	2	1	3	2	3
4EC07.2	3	3	3	1	2	3	2	1	2	3	1	1	3	2	3
4EC07.3	3	3	3	1	2	3	2	1	2	2	2	1	3	2	3
4EC07.4	3	3	3	1	3	2	2	1	2	3	2	1	3	2	3
4EC07.5	3	1	3	1	3	2	2	1	2	1	1	1	3	2	3

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC07.6	3	1	3	1	3	2	2	1	2	3	1	1	3	2	3
Average	3	2.66	3	1	2.5	2.33	2	1	2	2.16	1.5	1	3	2	3

Delivery Methods:

1. Experts from Industry (in person or through online mode)
2. Flip class (based on case studies)
3. Discussion
4. Industry visits.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC07.1	**Quiz, Active learning Assignment, Presentation, case studies**
2.	4EC07.2	**Quiz, Active learning Assignment, Presentation, case studies**
3.	4EC07.3	**Quiz, Active learning Assignment, Presentation, case studies**
4.	4EC07.4	**Quiz, Active learning Assignment, Presentation, case studies**
5.	4EC07.5	**Quiz, Active learning Assignment, Presentation, case studies**
6.	4EC07.6	**Quiz, Active learning Assignment, Presentation, case studies**

4EC08: Guided Research
Credits - 2 (L=0, T=0, P=4)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To provide guidance in research problem formulation, report writing, research paper formatting, patent drafting etc.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
0	0	4	2	00	00	40	60	100

Details of Assessment Instruments under CE Practical Component

Continuous Evaluation [30 Marks]	Continuous Evaluation [10 Marks]
Literature review of research paper, Journal/ Conference Paper drafting, Prepare File	Attendance/Assignments/Quiz

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Research Methodology:** Meaning of research, Objectives of research, Motivation in research, Types of research, Research Approaches, Significance of research. **Exercise:** Literature review on selected topics and prepare summary. **Tools:** ieeexplore.ieee.org, www.ipindia.nic.in, patents.google.com	06	15%
2	**Defining the Research Problem:** What is a research problem?, Selecting the problem, Necessity of defining the problem, techniques involved in defining a problem. **Exercise:** Identify anyone research problem. **Tools:** ieeexplore.ieee.org, www.ipindia.nic.in, patents.google.com	06	15%
3	**Qualitative and Quantitative Research:**	08	15%

	Discussion: Qualitative research; Quantitative research; Concept of measurement; causality; generalization; replication; Merging the two approaches; Journal and Conference papers; Impact factor; h index; i10 index; **Exercise:** Case study of impact factors, h index and i10 index. **Tools:** Minitab, MATLAB, Data analystic tools in excel, Google scholar, Vidwan, Orcid ID, Scopus index		
4	**Interpretation and Report Writing:** Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Report writing Tools: LaTex, Microsoft word, Presentation tools: Beamer, Microsoft Powerpoint Presentation (Animation) etc. **Exercise:** Preparation of a presentations on selected topics. **Tools:** Microsoft PPT (Animation), Latex, MikTex, Beamer	14	20%
5	**Research Paper Writing:** Discussion, Demonstration and Hands on Practice: Layout of a Research Paper, Ethical issues related to publishing, Reference Management Software, Software for paper formatting, Plagiarism and Self-Plagiarism. **Exercise:** Preparation of a sample research paper. **Tools:** MS Word (Symbol, Equation editor etc.), Latex, Format of reputed journal of Springer, Elsevier, IEEE etc.	10	20%
6	**Patent Search and drafting:** What is Patent, Types of Patent, Intellectual Property Rights, Patent Search Methods: websites, tools, How to draft the patent? **Exercise:** Preparation of Patent search analysis report and patent drafting. **Tools:** www.ipindia.nic.in, patents.google.com	10	15%
	Total	54	100 %

Reference Books:

1. C.R.Kothari, "*Research Methodology – Methods and Techniques*", New Age International Publishers, 2nd Revised Edition, 2004.
2. Emma Bell, Alan Bryman, Bill Harley, "*Business Research Methods*", Oxford University Press, 5th Edition.

3. Rowena Murray, "*How to write a thesis*", Tata McGraw Hill, 3rd Edition.
4. Graziano, A.M., Raulin, M.L, "*Research Methods- A Process of Inquiry*", Pearson Publications.
5. Dr. S. R. Myneni, "*Patent drafting and Specification writing*", New Era Law Publication.
6. IEEE, Elsevier, Springer, Scopus Index journals/conferences websites.

Course Outcomes (COs):

By learning this course students will be able to .....

1. Understand the basic concepts of research methodology.
2. Define and Identify research problem.
3. Compare qualitative and quantitative research.
4. Prepare the report and presentation using recent tools.
5. Design the research paper.
6. Analyse and draft the patent.

4EC41: Digital Image Processing
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

Describe and explain basic principles of digital image processing; design and implement algorithms that perform basic image processing, design and implement algorithms for advanced image analysis.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component

Internal Exams [30 Marks]	Continuous Assessments/ALA* [10 Marks]
Mid Sem Internal Exams	Quiz

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1.	**Introduction :** What Is Digital Image Processing, Fundamental Steps in Digital Image Processing, Fields that Use Digital Image Processing, Human Visual Perception, Image Sampling and Quantization, Basic Relationships Between Pixels,	07	16%
2.	**Image Enhancement and Filtering in Spatial Domain:** Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power-law transformation, Intensity level slicing and Bit-plane slicing. Image histogram, Histogram equalization process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering	07	17%

	(sharpening).		
3.	**Image Filtering in the Frequency Domain:** Introduction to Fourier Transform, Preliminary Concepts, Extension to functions of two variables, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphism filtering, 2D- DFT, 2D-FFT, 2D- DCT.	08	17%
4.	**Image Restoration and Segmentation:** Image Restoration Process, Restoration in the Presence of Noise, Estimating the Degradation Function, Wiener Filtering. Constrained least square filtering, Detection of Discontinuities, Edge Linking and Boundary Detection, Region-Based and Morphological Watersheds segmentation, Use of motion in segmentation.	08	17%
5.	**Image Representation and Description :** Purpose of representation, Types of representation, Boundary representation, Chain Code, Polygonal approximation, signature, boundary segments, Boundary description, Shape number, Fourier Descriptor	07	16%
6.	**Color Image Processing and Image Compression:** Color Models, Color Transformations and Color Segmentation. Coding, Interpixel and Psychovisual Redundancy, Image Compression Models, Elements of Information Theory, Variable-Length Coding, LZW Coding, Bit-Plane Coding, Lossless Predictive Coding, Lossy Predictive Coding, Transform Coding, Compression Standards.	08	17%
	Total	45	100 %

Reference Books :

1. Rafael C.Gonzalez, Richard E. Woods. *"Digital image processing."*, Third Edition, Pearson Education,2007
2. Jayaraman, S., S. Esakkirajan and T. Veerakumar, *"Digital Image Processing"*, McGraw Hill Publication, 1st Edition, 2017
3. R. C. Gonzalez, R. E. Woods, S. L. Eddins, *"Digital Image Processing Using MATLAB"*, 3rd edition, Gatesmark, 2020.
4. Sridhar," *Digital Image Processing*", Second Edition, Oxford University Press,2011
5. Sandipan Dey, *"Hands-On Image Processing with Python"*, Publisher Packt, 2018

Course Outcomes (COs) :

By learning this course students will be able to…

1. Comprehend the necessity and application of concepts of image processing.
2. Enhance the visual quality of an image using transformations and filters.
3. Develop an understanding and usage of image restoration, segmentation, representation and Description.
4. Distinguish the process of color image models and gray models.
5. Categorize the different image compression techniques for various applications.
6. Learn the various feature extraction algorithms in order to recognize objects.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC41.1	3	3	3	3	2	2	1	1	1	1	1	1	3	3	3
4EC41.2	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
4EC41.3	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
4EC41.4	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
4EC41.5	3	3	3	2	2	2	1	1	1	1	1	1	3	3	3
4EC41.6	3	3	3	3	3	3	1	1	3	1	1	1	3	3	3
Average	3.0	3.0	3.0	2.3	2.2	2.2	1.0	1.0	1.3	1.0	1.0	1.0	3.0	3.0	3.0

Delivery Methods:

1. Lectures through Blackboard/ power-point slides and videos.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	4EC42.1	**Exam, Assignments, Quiz, Practical, Project**
2.	4EC42.2	**Exam, Assignments, Quiz, Practical, Project**
3.	4EC42.3	**Exam, Assignments, Quiz, Practical, Project**
4.	4EC42.4	**Exam, Assignments, Quiz, Practical, Project**
5.	4EC42.5	**Exam, Assignments, Quiz, Practical, Project**
6.	4EC42.6	**Exam, Assignments, Quiz, Practical, Project**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
15%	15%	20%	20%	20%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Details of Assessment Instruments under CE Practical Component: (20 marks)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

20-mark distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Project/OEP	Total
05	00	05	10	20

List of Experiments:

Sr. No	Aim
	MATLAB Based
1.	Introduction to image processing toolbox in MATLAB
2.	Read and display an image, RGB to gray, gray slicing, negatives using MATLAB
3.	Logical and Arithmetic Operation on an Image using MATLAB
4.	Histogram, Contrast stretching, Image enhancement using MATLAB
5.	Detect and Measure Circular Objects in an Image using MATLAB
6.	Write a program to bit plane slicing on the given image using MATLAB
7.	Write a program to remove noise from an image using an averaging operation in MATLAB.
8.	Filtering in Spatial Domain using MATLAB.
9.	Low Pass and Band Pass Filtering using MATLAB.
10.	Filtering in Frequency Domain using MATLAB.
11.	To compare Spatial and Frequency domain using MATLAB.
12.	To obtain Edge detection w/o operator using MATLAB.
13.	Dilation and Erosion using MATLAB.
14.	Use of Wavelet Transforms for Image Processing Applications.
15.	Edge Detection using the internal function of MATLAB.
16.	Image compression techniques / Huffman Coding using MATLAB.
	Python / OpenCV Based
17.	Write a Python program using OpenCV to read and show an image.
18.	Write a Python program using OpenCV to plot lines on the image using pixel

	coordinates.
19.	Write a Python program using OpenCV to capture video until q is pressed
20.	Write a Python program using OpenCV to capture video and store in a color frame with the desired file name.
21.	Write a Python program using OpenCV to put different shapes and text on an image.
22.	Write a Python program using OpenCV to perform arithmetic and logical operations on an image.
23.	Write a Python program using OpenCV to perform image thresholding operations on an image.
24.	Write a Python program using OpenCV to perform face, mouth and eye detection using Haar Cascade classifier.
25.	Write a Python program using OpenCV for color tracking via a camera feed.
26.	Write a Python program facial expression analysis and recognition
27.	Write a Python program for classification using facial images with score-level fusion.

Lab Resources:

- MATLAB, Jupyter Notebook and Python

Open-Ended Problem:

A significant part of this course is to study Digital Image Processing Techniques. In this students should identify the real-world problem and apply an Image Processing Techniques to solve the problems. Few of the examples are **Handwritten OCR for Indian Languages, Face Detection and Recognition with different Noise, Medical diagnosis, Autonomous driving, etc.**

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4EC42: Biomedical Instrumentation
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To understand the concepts of various anatomy of the human body and related to that, the designing of fundamental instrumentation circuits using appropriate sensors. This subject will help to learn the concepts of the various bio-potentials related to the human body which can help them to make real-time healthcare applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component

Internal Exams [30 Marks]	Continuous Assessments/ALA* [10 Marks]
Mid Sem Internal Exams	Attendance /Assignments / Quiz

***ALA: Active Learning Assignments**

Details of Assessment Instruments under CE Practical Component

Term Work [20 Marks]	Continuous Assessments /OEP* [10 Marks]
Lab file, log-book, attendance	OEP, Experiments Performance

***OEP: Open Ended Problems**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction of Biomedical Instrumentation:** Medicine and Medical Devices a review, Generalized block diagram of the medical instrumentation system, Classification of Biomedical Instruments. Interference in the measurements and modifying inputs, Compensation techniques.	04	10%

2	**Bio-Potentials:** Human body and Cell structure, Electrical Activity of Excitable Cells, The action and Resting potentials. Introduction of Bio-potentials related to the human body. ECG, EMG, EEG, ERG etc.	06	15%
3	**Bioelectrodes-Sensors-Transducers:** Introduction of resistive, capacitive and inductive sensors, Piezoelectric sensor, displacement and temperature measurement, optical and radiation sensors-transducers, Introduction and Classifications of the Bio-electrodes.	08	20%
4	**Cardiovascular system and measurements :** The anatomy of human heart. Electrocardiogram generation and measurements, The ECG Instrumentation lead techniques and signal conditioning, Measurement of Blood pressure, blood flow, blood volume and heart sound, Special techniques of ECG measurement. Introduction of ECG Bio-signal Processing and Signal Conditioning.	08	20%
5	**Biomedical measurements and Equipments:** Digital revolution in the biomedical equipment's, EEG and its measurements. 10-20 measurements. Heart Rate and Pace-Makers, Defibrillators, Imaging techniques and its fundamentals, X-Ray, MRI, CT-Scan, Radiography, PET Scan, Ultrasonography, laser and robotics surgery equipments, Equipments in ICU and Patient monitoring systems.	08	20%
6	**Electrical Hazards and Patient safety :** Physiological effect of the electrical current on human, Significance of electrical danger, Micro and Macro shocks, Ground shocks, Hazards and methods of Accident prevention.	06	15%
	Total	40	100 %

Reference Books :

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, *"Biomedical Instrumentation and Measurements"*,PHI Private Limited,2nd Edition, 2012.
2. John G. Webster, *"Medical Instrumentation Application and Design"*, WSE Wiley India Private Limited, 3rd Edition, 2012.
3. Joseph J. Carr, John M. Brown, *"Introduction to Biomedical Equipment Technology"*, Pearson Education, 4th Edition, 2012.

4. R S. Khandpur, *"Handbook of Biomedical Instrumentation"*, Tata McGraw Hill, 2nd Edition, 2002.
5. Rangaraj M Rangayyan, "Biomedical Signal Analysis: A Case-Study Approach",Wiley India, 2011.

Course Outcomes (COs):

By learning this course students will be able to

1. Recollect the basic knowledge of anatomy and physiology of human body.
2. Understand & Analyze important vital sign parameters to evaluate certain disease.
3. Categorize the differences of bio-potentials and its characteristics
4. Design bio-potential fundamental circuits and implement it for demonstration.
5. Study and measure various medical bio potentials.
6. Test safety related to electrical hazards and troubleshooting of biomedical instruments.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC042.1	1	2	2	1	1	1	-	-	-	-	-	1	-	-	1
4EC042.2	3	3	2	2	2	1	-	-	-	-	1	-	1	1	1
4EC042.3	3	2	2	1	1	-	-	-	-	-	-	-	-	1	1
4EC042.4	3	2	3	2	3	1	-	1	2	1	1	-	2	2	2
4EC042.5	3	3	2	2	2	-	-	-	1	1	-	1	2	2	2
4EC042.6	3	3	3	2	2	1	-	-	-	-	-	1	2	2	2
Average	2.67	2.50	2.33	1.67	1.83	0.67	0.00	0.17	0.50	0.33	0.33	0.50	1.17	1.33	1.50

Delivery Methods:

1. Lectures through Blackboard-Digital Board/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Biomedical Trainer kits, Signal Processing on simulation tools or related open source software, Bread board, Active & Passive Components, ICs, Function Generator, Oscilloscopes, Digital Multi-meter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC042.1	**Exam, Presentation, Assignments**
2.	4EC042.2	**Exam, Presentation, Field Visit,**
3.	4EC042.3	**Exam, Experiments, Assignments**
4.	4EC042.4	**Experiments, Exam, Open ended problems, Field visit**
5.	4EC042.5	**Exam, Assignments, Experiments**

6.	4EC042.6	**Presentation, Field Visit, Assignment**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

OEP: Few Open Ended Problems

1. Implementation of the detection of ECG and analysis of the same.
2. Design Noise removing and filtering circuit of ECG bio-potential.
3. Signal processing of various bio-potentials using software, detection of event related potentials.
4. Bio-equipment safety circuit design for electric hazards prevention.

List of Experiments:

Sr. No	Experiments
1.	Study of Physiological system of human body.
2.	To study EEG Simulator
3.	To study ECG Simulator
4.	To study ECG System
5.	Filtering of the Bio-potential using software.
6.	Noise removal of ECG Signal using Simulation Tools
7.	Event Detection of the ECG signal Simulation Tools
8.	To Study ECG Telemetry System
9.	To Study of Finger pleythysmography
10.	To Study Blood flow Meter
11.	To study about Heart Rate meter and simulator
12.	To study about EMG simulator.

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4EC43: RF and Microwave Engineering
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To learn fundamentals of Microwave transmission lines, waveguides, Active and passive Microwave Devices, Microwave Components & its applications and recent trends.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component:

Internal Exams [30 Marks]	Continuous Assessments/ALA* [10 Marks]
Mid Sem. Internal Exams	Attendance /ALA / Quiz

***ALA: Active Learning Assignments**

Details of Assessment Instruments under CE Practical Component:

Term work [20 Marks]	Continuous Assessment [10 Marks]
Attendance , Lab File , OEP	Experiment Performance/ Questions & Answers

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction to Microwaves :** Microwave Frequency bands, requirement of Microwave Frequencies, Advantages of Microwaves, Applications of Microwaves .	03	10%
2	**Microwave Transmission Lines and Waveguides:** Transmission line Voltage and Current Relationship, Propagation Constant, Characteristic Impedance, reflection coefficient, standing waves, SWR, line	10	20%

	impedance and admittance, Impedance Matching and Smith chart, Concept of TE, TM, TEM Mode, Losses associated with microwave Transmission, Rectangular waveguides-theory and analysis, Principle of circular waveguide, Rectangular Cavity Resonator.		
3	**Microstrip Lines :** Introduction to strip lines, Micro strip lines, parallel strip lines, coplanar strip lines, effect of dielectric constant, introduction to metamaterial.	06	10%
4	**Microwave Components :** S-Parameter basics, Waveguide Tees, Directional Couplers, Wave-guide Corners, Bends, Twists, Circulators, Isolator , Introduction to Microwave Filters .	07	15%
5	**Microwave Tubes :** Klystrons, Helix and High power gridded control traveling wave tube, Magnetron Oscillators.	06	15%
6	**Semiconductor Microwave Devices** : Microwave bipolar and hetero junction Transistors, Varactor diode, PIN diode, Tunnel Diode, Gunn Diode, IMPATT and TRAPATT diode, Step recovery diodes, Schottky Barrier diodes, Parametric Amplifiers.	07	15%
7	**Microwave Systems, Measurements and applications :** Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Measurement of Microwave antenna parameters. Microwave antennas, Basic radar principle, Radar range equation, Types of radar, Radiometer System, Microwave Remote sensing, Introduction to RF MEMS, Introduction to Silicon Photonics .	06	20%
	Total	45	100 %

Reference Books :

1. M.Kulkarni, "*Microwave and Radar Engineering*", Umesh Publishers, 4th Edition, 2016.
2. Samuel Y. Liao, "*Microwave Devices and Circuit*", PHI, 3rd Edition, 2003
3. Edgar Hund , "*Microwave Communications: Components and Circuits*", McGraw Hill, ISE Edition, 1989
4. David M Pozar, "*Microwave Engineering*", Wiley, 3rd Edition, 2010
5. Annapurna Das, Sisir K. Das , "*Microwave Engineering*", Tata McGraw Hill, 3/E, 2000.

Course Outcomes (COs) :

By learning this course students will be able to.....

1. Understand and remember basic concepts and applications of microwave systems.
2. Analyse and solve problems related to microwave transmission lines.
3. Design, analyse and solve problems related to microwave waveguide
4. Analyse, test and use, maintain various microwave components.
5. Design simple microwave strip lines, couplers, Microwave filters
6. Understand Concepts of Microwave tubes , Semiconducting device, Measurements.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC43.1	2	1	1	1	2	1	-	-	2	-	2	1	2	1	2
4EC43.2	2	3	2	3	2	1	-	-	2	-	2	2	2	1	2
4EC43.3	2	3	3	3	2	1	-	2	2	-	2	1	2	3	2
4EC43.4	2	2	2	2	2	1	-	2	2	-	2	2	2	3	2
4EC43.5	2	2	3	2	2	1	-	2	2	-	2	2	2	3	2
4EC43.6	2	1	1	1	2	1	-	-	2	-	2	1	2	1	2
Average	2	2	2	2	2	1	-	0.33	2	-	2	1.5	2	2	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Microwave test bench, Microwave sources, SWR meter, Available software, Oscilloscopes, Digital Multimeter, Power Supply etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC43.1	**Exam, Assignments, Presentation, Experiments**
2.	4EC43.2	**Exam, Assignments, Experiments, Field Visit**
3.	4EC43.3	**Exam, Assignments, Experiments, OEP**
4.	4EC43.4	**Exam, Assignments, Experiments, OEP**
5.	4EC43.5	**Exam, Assignments, Experiments, OEP**
6.	4EC43.6	**Exam, Assignments, Presentation, Experiments**

Open Ended Problems (OEP):

1. Designing and simulation of Microwave Antenna, cavity resonator.
2. Designing and simulation of micro-strip line, Microwave Filter
3. To measure Resonance frequency of cavity resonator.

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

List of Experiments:

Sr. No.	**Aim**
1.	Study of Different microwave components and setting up microwave test bench
2.	To study Characteristics of reflex klystron Oscillator
3.	To determine the frequency & wavelength in a rectangular waveguide working in TE10 mode.
4.	To determine the standing wave ratio and reflection coefficient
5.	To study waveguide Tees
6.	Study of function of multi hole directional coupler by measuring performance parameters
7.	To measure Insertion loss and isolation of isolator/circulator
8.	To study VI Characteristics of Gunn diode Oscillator
9.	Design and simulation of Rectangular and circular waveguide
10.	Design and simulation of E-plane Tee and H-Plane Tee
11.	Design and simulation of Magic Tee (Hybrid Tee)
12.	Design and simulation of Microstrip patch antenna

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4EC44: Radar and Navigational Aids
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective :

To provide knowledge of the basic concepts, operation and applications of various radar systems and navigational aids.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component:

Internal Exams [30 Marks]	Continuous Assessment/ALA* [10 Marks]
Mid Sem Internal Exams	Attendance /ALA/Quiz

***ALA: Active Learning Assignments**

Details of Assessment Instruments under CE Practical Component:

Term work [20 Marks]	Continuous Assessment [10 Marks]
Attendance, Lab File, Open Ended Problem	Experiment Performance/Questions & Answers

***OEP: Open Ended Problem**

Course Contents :

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction :** Basic principle, Radar waveform, powers and energy, Simple Form of Radar Range Equation, Block diagram and operation, Radar Displays, Duplexers, Radar Frequencies, millimeter and submillimeter waves, Applications of Radar.	04	07
2	**Radar Equation :**	08	14

	Prediction of Range, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Integration of radar Pulses, Radar Cross Section of Targets, Cross section Fluctuations and Models, surface clutter, sea clutter, Weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities, system losses, propagation effects, other overall considerations.		
3	**CW Radar,FM CW Radar,MTI Radar :** Doppler effect, CW radar, FM CW radar, Airborne Doppler Navigation, Multiple Frequency CW radar, Introduction to MTI Radar, Delay line Cancellers, Staggered Pulse Repetition Frequencies, Range gated Doppler Filters, Block Diagram of Digital Signal Processor, Example of MTI radar Processor, Pulse Doppler Radar, Airborne radar.	07	21
4	**Tracking , Imaging and Electronic Scanning Radar :** Tracking with Radar, Monopulse tracking, Conical scan and Sequential lobing, Advantages, capabilities, Introduction to Synthetic aperture radar(SAR), phased array principle of electronic scanning, block diagram of an electronic scanning system and its operation	05	10
5	**Navigation,Radio Direction Findings,Radio Ranges** : Introduction, Four Methods of Navigation,Loop Antenna, Loop input circuits, aural null direction finder, Gonio meter, Adcock Direction Finder, Automatic Direction Finders,LF/MF Four course Radio Range, VHF Omni Directional Range, VOR receiving & Ground Equipment.	10	23
6	**Hyperbolic Systems of Navigation, Approach and Landing Aids :** LORAN, DECCA navigation systems, Instrument Landing System, Ground controlled, Approach System, Microwave landing System, DME, TACAN	07	15
7	**Recent trends in Navigation** : GPS principle of operation, Track stabilization, Position - location determination, GPS receiver and applications, GLONASS and Compass, Maritime satellite , GAGAN, Galileo, IRNSS, NAVIC Receiver and applications. Case studies : NISAR,RISAT-2 ,RISAT 2B, RISAT-2BR1, GPR, InSAR	04	10
	Total Hours	45	100

Reference Books :

1. M.I. Skolnik, "*Introduction to Radar System*", McGraw Hill, 3rd Edition, 2001
2. N S Nagraja, "*Elements of Electronic Navigation Systems*", McGraw-Hill, 2/E, 2001.
3. A.K Sen and A.B Bhattacharya, "*Radar Systems and Radio Aids to Navigation*", Khanna Publishers, 6/E, 2009.
4. Peyton Z. Peebles, "*Radar Priciples*", 2nd Edition, John Wiley and sons, 2007.
5. Mohinder S. Grewal, Lawrence R. Weill, Angus P. Andrews, "*Global Positioning Systems, Inertial Navigation, and Integration*", John Wiley & Sons, 2/E, 2007.

Course Outcomes (COs) :

By learning this course students will be able to

1. Understand basic concepts and applications of radar systems and navigational aids.
2. Acquire the knowledge of different Radar transmitters and receivers.
3. Analyze, test and use various radar & navigational aids for different applications.
4. Analyze and Solve simple problems related to Radar systems.
5. Design, simulate and implement simple radar system, Component or process.
6. Remember the basic operations of different Navigational aids and satellite systems

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC44.1	3	2	2	2	2	2	-	1	2	-	-	2	2	2	2
4EC44.2	3	2	2	2	2	1	-	1	2	-	-	2	2	2	2
4EC44.3	3	2	2	1	2	2	-	1	2	-	-	2	2	2	2
4EC44.4	3	3	2	2	2	1	-	1	2	-	-	2	2	2	2
4EC44.5	3	2	2	1	2	1	-	1	2	-	-	2	2	2	2
4EC44.6	3	2	2	1	2	2	-	2	2	-	-	2	2	2	2
Average	3	2.1	2	1.5	2	1.5	-	1.1	2	-	-	2	2	2	2

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using RADAR Trainer kits, MATLAB, Oscilloscopes, and Digital Multimeter etc.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC44.1	**Exam, Assignments, Experiments, Quiz**
2.	4EC44.2	**Exam, Assignments, Experiments**

3.	4EC44.3	**Exam, Assignments, Experiments, OEP**
4.	4EC44.4	**Exam, Assignments, Presentation, Experiments, OEP**
5.	4EC44.5	**Exam, Assignments, Experiments, OEP**
6.	4EC44.6	**Exam, Assignments, Experiments**

Suggested specification table with marks (Theory) :

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

List of Experiments :

Sr. No.	Aim
1.	Introduction to different RADAR Systems
2.	Analysis of RADAR Range Equation
3.	Analysis of Radar Signal to Noise Ratio against target detection range for different values of target Radar cross section.
4.	Analysis of Radar Signal to Noise Ratio against target detection range for different values of Radar peak Power
5.	Study of delay line cancellers Using MATLAB
6.	Determination of the speed of the object moving in the Radar range
7.	Understanding the principle of Doppler Radar of Time and Frequency measurement with the help of moving pendulum
8.	Study of the object counting with the help of Radar
9.	Study the effect of different types of materials on Radar receiving or detection
10.	Understanding the principle of GPS Technology
11.	Establishing Link between GPS and Satellite
12.	Position and Location determination using GPS Receiver
13.	To study & interpret the data on the display pertaining to location of vehicles (air crafts/ships) and collision avoidance.

Open Ended Problems (OEP) :

1. Introduction to RADAR Equation using MATLAB SNR versus detection range for three

different values of radar peak power.

2. Plot of RCS, SNR, Detection Range using MATLAB SNR versus detection range for three different values of RCS
   I. SNR versus detection range for three different values of RCS.
   II. SNR versus detection range for three different values of radar peak power.
3. Obtain Graph of Circular Dish Antenna pattern using MATLAB
4. Obtain Graph of Rectangular Array Antenna using MATLAB

4EC45: Machine Learning
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To learn basic concept of various learning methods, mathematical concepts and algorithms used in machine learning to discover patterns in the data and then make predictions based on often complex patterns to answer real world questions, detect and analyse trends and help to solve problems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component

Internal Exams [30 Marks]	Continuous Assessment/ALA* [10 Marks]
Mid Sem Internal Exams	Quiz

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Introduction to Machine Learning :** Overview of Machine Learning, Supervised and Unsupervised Learning, Reinforcement Learning, Application of Machine Learning and Review of Linear Algebra.	04	10%
2	**Regression and Classification :** Supervised Learning – Introduction, Hypothesis Representation, Cost Function, Gradient Descent Algorithm, Linear Regression with Single and Multiple Variables, Feature Scaling, Learning Rate, Logistic Regression, Problem of Under and Over Fitting with Linear and Logistic Regression, Regularized Linear and Logistic Regression, Support Vector Machines (SVM),	08	20%

	Large Margin Classifiers and SVM Kernels.		
3	**Clustering and Dimensionality Reduction :** Unsupervised Learning – Introduction, K-Means Algorithm, K-Means for Non-Separated Clusters, K-Means Optimization Objective, DBSCAN, Introduction to Principle Component Analysis (PCA) Algorithm, Reconstruction from Compressed Representation, Choosing the number of Principle Components and Applications of PCA.	08	20%
4	**Artificial Neural Network :** Introduction, Neural Network and Model Representation, Forward Propagation, Neural Network Cost Function, Back Propagation, Gradient Checking, Error Minimization and Neural Network's Applications, Convolution Neural Network (CNN) and Recurrent Neural Network (RNN).	08	15%
5	**Machine Learning System Design :** Introduction, Advice for Applying Machine Learning Techniques, Model Selection and Training, Cross Validation and Test Sets, Diagnosis - Bias v/s Variance, Regularization and Bias/Variance, Learning Curves, Skewed Classes, Precision and Recall.	04	10%
6	**Reinforcement Learning :** Introduction, The Learning Task, Q – Learning, The Q – Function and An Algorithm for Learning Q.	05	10%
7	**Application of Machine Learning :** Anomaly Detection, Recommender Systems, Content-based Recommender Systems and Collaborative Filtering, Transter Learning - One-Shot Learning and Zero-Shot Learning.	08	15%
	Total	45	100 %

Reference Books :

1. Tom M. Mitchell, "*Machine learning*", McGraw Hill, 1st Edition, 1997.
2. Rajasekaran, Sanguthevar and GA Vijayalakshmi Pai, *"Neural networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications"*, PHI, Paperback Edition, 2003.
3. Bishop, Christopher M, *"Pattern Recognition and Machine Learning"*, Springer, 1st Edition, 2006.
4. Dutt, Chandramouli and Das, *"Machine Learning"*, Pearson, 1st Edition, 2018.

Course Outcomes (COs) :

By learning this course students will be able to…

1. Understand fundamental issues and challenges of machine learning like a data, model selection and model complexity etc.
2. Design and implement various supervised and un-supervised machine learning techniques.
3. Develop an appreciation for what is involved in learning models from data.
4. Analyze how to evaluate models generated from data.
5. Apply various machine learning algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
6. Understand the concept of reinforcement learning and deep learning.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC45.1	2	1	2	2	3	1	1	2	2	1	1	2	1	1	1
4EC45.2	3	2	2	3	3	2	1	1	3	2	2	3	1	2	2
4EC45.3	2	3	3	2	2	1	2	1	2	1	2	2	1	2	3
4EC45.4	2	3	3	3	3	1	1	2	3	1	1	3	2	2	3
4EC45.5	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
4EC45.6	2	3	3	3	3	1	1	2	2	2	1	3	2	3	2
Average	2.33	2.5	2.66	2.66	2.83	1.5	1.33	1.66	2.33	1.5	1.66	2.66	1.66	2.16	2.33

Delivery Methods:

1. Lectures through Blackboard/ Power-Point Slides and Videos.

Constituent COs in Assessment Tools :

Sr. No	Course Outcomes	Assessment tools
1.	4EC45.1	**Exam and Quiz**
2.	4EC45.2	**Exam and Quiz**
3.	4EC45.3	**Exam and Quiz**
4.	4EC45.4	**Exam and Quiz**
5.	4EC45.5	**Exam and Quiz**
6.	4EC45.6	**Exam and Quiz**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
10%	15%	20%	20%	20%	15%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Details of Assessment Instruments under CE Practical Component: (30 mark)

Tutorial/practical work (both end-semester and continuous) shall be evaluated on the basis of the following instruments of assessment: observation of experimental skills, reports, oral examination, quizzes, attendance

30-marks distribution (Internal Continuous Evaluation)

File	Viva	Attendance	Project/OEP	Total
10	00	10	10	30

List of Experiments:

Sr. No	Aim
1	Study of Jupyter Notebook and Machine Learning libraries.
2	Write a pyhton program to implement a Linear Regression with Single Variable.
3	Write a pyhton program to implement a Linear Regression with Multiple Variables.
4	Write a python program to implement a Logistic Regression – Binary Classification.
5	Write a python program to implement a Logistic Regression – Multiple Classification.
6	Write a python program to implement a Gradient Descent Algorithm.
7	Write a python program to implement the concept of Neural Network.
8	Write a python program to implement a Convolution Neural Network (CNN) algorithm for pattern classification.
9	Write a python program to implement a Support Vector Machine (SVM) algorithm as a large margin classifier.
10	Write a python program to implement the concept of K – Means Clustering algorithm.
11	Write a python program to implement the concept of dimension reductinality using Principle Component Analysis (PCA) algorithm.
12	Write a python program to implement the concept of Q – Learning to maximize high score of balancing game in gym.
13	Write a python program for implementation of Movie Recommender System.

Lab Resources:

- Ubuntu 20.04.01 (LTS) Focal Fossa, Anaconda Navigator, Jupyter Notebook and Spyder with Python 3.7.

Open Ended Problem:

Significant part of this course is to study an artificial neural network structure. In this students should identify an application area, state the real world problem and apply an artificial neural networks to solve the problems such as to **Robotic Navigation and Control, Data Mining, Autonomous Navigation, Bioinformatics, Speech Recognition, and Text & Web Data Processing.**

ELECTRONICS & COMMUNICATION DEPARTMENT
BIRLA VISHVAKARMA MAHAVIDYALAYA
An Autonomous Institution
BVM (Engineering College)
Managed by – Charutar Vidya Mandal
Vallabh Vidyanagar – 388120
Gujarat, India

4EC46: Advance Communication Systems
Credits - 4 (L=3, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To provide comprehensive and advanced knowledge of broadband wireless communication areas like time diversity, space diversity, frequency diversity, coding and decoding, equalization, smart antenna techniques, multiuser detection and receiver.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Details of Assessment Instruments under CE Theory Component

Internal Exams[30 Marks]	Continuous Assessments[10 Marks]
Mid Sem Internal Exams	Attendance/Assignments /Quiz

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Wireless Communications and Diversity :** Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space, Data rate and diversity.	08	15%
2	**Broadband Wireless Channel Modeling :** WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Autocorrelation, Jakes Spectrum, Impact of Doppler Fading, Autocorrelation function, Crosscorrelation function, Power spectal density.	08	20%
3	**CDMA & UWB :** Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization,	08	15%

	Ultrawideband: Define, Frequency range & its applications, BER analysis of UWB.		
4	**OFDM :** Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues, Simulation of OFDM with different modulation technique, Analysis of PAPR vs CCDF.	07	15%
5	**MIMO :** Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM, LTE, Massive MIMO.	07	20%
6	**Cellular Systems:** Channel reuse, Multiple access, Interference management, Dynamic resource allocation: Cognitive Radio, Narrowband systems: GSM, Wideband systems: OFDM and CDMA, Cellular phone standards.	07	15%
	Total	45	100 %

Reference Books:

1. David Tse and PramodViswanath, *"Fundamentals of Wireless Communications"*, Cambridge University Press, 1st Edition, 2006.
2. A Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
3. S. Rappaport, *"Wireless Communications – Principles and Practice"*, Pearson Education, 2nd Edition, 2012.
4. W. C. Y. Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecommunications, 2nd Edition, 1998.
5. EzioBiglieri, *"MIMO Wireless Communications"*, Cambridge University Press, 1st Edition, 2007.

Course Outcomes (COs):

By learning this course students will be able to .....

1. Understand the basic concepts of wireless communications.
2. Describe and differentiate forth generations of wireless standard and networks.
3. Design wireless communication systems with key 3G and 4G technologies.
4. Analyze the Error performance of Ultra-Wide Band systems.
5. Analyze multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.
6. Understand the recent trends of wireless communication system.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC46.1	2	2	1	1	0	0	1	0	0	1	1	1	2	1	2
4EC46.2	3	3	2	3	2	0	1	0	0	2	1	2	3	3	3
4EC46.3	3	3	2	3	3	0	1	0	0	2	1	2	3	3	3
4EC46.4	3	3	1	3	3	0	1	0	0	1	1	1	3	3	3
4EC46.5	2	2	2	1	2	0	1	0	0	2	1	2	3	2	3
4EC46.6	2	2	2	1	1	0	1	0	0	2	1	2	3	3	2
Average	2.5	2.5	1.6	2.0	1.83	0	1	0	0	1.6	1	1.6	2.8	2.5	2.6

Delivery Methods:

1. Lectures through Blackboard and power-point slides.

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC46.1	**Exam, Assignments, Presentation**
2.	4EC46.2	**Exam, Assignments, Presentation**
3.	4EC46.3	**Exam, Assignments, Presentation**
4.	4EC46.4	**Exam, Assignments, Presentation**
5.	4EC46.5	**Exam, Assignments, Presentation**
6.	4EC46.6	**Exam, Assignments, Presentation**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	20	20	15	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

List of Experiments:

Sr No.	Title
1.	Write the MATLAB code to plot BER V/S SNR for Selection combining diversity technique.
2.	Write the MATLAB code to plot BER V/S SNR for Maximum Ratio combining diversity technique.
3.	Write the MATLAB code to plot BER V/S SNR for Equal Gain combining

	diversity technique.
4.	Write the MATLAB code to plot BER V/S SNR for Rake Receiver technique.
5.	Write the MATLAB code to plot PAPR V/S CCDF for OFDM Modulation technique.
6.	Write the MATLAB code to plot BER V/S SNR for SISO technique.
7.	Write the MATLAB code to plot BER V/S SNR for SIMO technique.
8.	Write the MATLAB code to plot BER V/S SNR for MISO technique.
9.	Write the MATLAB code to plot BER V/S SNR for MIMO technique.
10.	Write the MATLAB code to plot BER V/S SNR for OSTBC technique.

Open Ended Problem:

- **3G - Design wireless communication system with multiple transmitting and receiving antenna with non-orthgonal approaches (3rd Generation Wireless Communication System).**
- **4G - Design wireless communication system with multiple transmitting and receiving antenna with Orthgonal approaches (4th Generation Wireless Communication System).**
- **5G - Design wireless communication system with Massive multiple transmitting and receiving antenna with Orthgonal approaches with multiuser communication. (5th Generation Wireless Communication System).**

4EC47: Virtual Instrumentation
Credits - 2 (L=1, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective:

Make use of software platform for analysis and application design for computer based measurement and automation systems. Integrate MCU for acquisition and communication interface..

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	2	30	20	20	30	100

Details of Assessment Instruments under CE Theory Component

Internal Exams [10 Marks]	Continuous Assessment/ALA* [10 Marks]
Mid Sem Internal Exams	Attendance /Assignments / Quiz/OEP

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	% Weightage
1.	**Virtual Instrumentation:** Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI.	1	10
2.	**VI programming techniques:** VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.	3	20

Unit No.	Topics	Teaching Hours	% Weightage
3.	**Data acquisition basics**: Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. ADC, DAC. Arduino interfacing and programming with NI LabVIEW. Data Presentations and SCADA.	3	20
4.	**Data logging and Report Generation:** File formats for data logging, Database for data logging, Use of spreadsheet for data logging, Report generation and printing word formats. ARM MCU integrating for Ethernet communication.	3	20
5.	**Use of VI for IOT Integration:** Internet Toolkit. IOT application with ESP8266. IOT cloud integration.	3	20
6.	**Application building:** State Machines: Using case and event structures. Login Interface and credentials, VI execution behavior. Building setup and exe.	2	10
	Total	15	100

Practical List

Sr. N0	List
1.	Introduction to NI LabVIEW and NI ElVIS
2.	Graphical programming : Structures, data types, arrays, clusters.
3.	Reading and writing data to different file types: txt, csv, tdms.
4.	Generate a 2D numeric array using random numbers. Display the generated values in a waveform graph. Write the same values in a spreadsheet file and text file.
5.	Read a spreadsheet and text file which consists of multiple columns. Display the contents in a waveform.
6.	Representation of data and its processing for analysis(amplifying, filtering, etc)
7.	Create a login page with user name and password. Store data in spreadsheet.
8.	Data acquisition using NI ELVIS and logging
9.	Integrating IOT with data acquisition system
10.	Temperature monitoring and control using IOT.
11.	Make use of data sockets for synchronous communication of control and data.
12.	Make a traffic signal using sequential state machine.
13.	Arduino – based SCADA. Temperature monitoring and control using LM32 and Fan/heater
14.	ARM controller based – Ethernet communication enable DAQ.

15.	IOT application with ESP8266.

Reference Books :

1. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki *"LabView: Advanced Programming Techniques"*, Second Edition, CRC Press 2006
2. National Instruments Malan Shiralkar *"LabVIEW Graphical Programming Course"*, National Instruments, 2007
3. Ronald W. Larsen *"LabVIEW for Engineers"*, Prentice Hall, 2011
4. Virtual Instrumentation using LabVIEW by Sanjeev Gupta
5. LabVIEW Basic 1 & Basic 2 course guide by National Instruments

Course Outcomes (COs) :

By learning this course students will be able to…

1. Differentiate conventional programming and graphical styles
2. Recollect and compare basic knowledge of programming languages.
3. Understand basics of acquisition techniques and its interface
4. Understand & use data handling for representation and analysis
5. Design and test interfacing techniques for IOT application.
6. Use state machines to solve complex problems and for applications development.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC047.1	3	3	3	2	2	1	-	-	-	-	-	1	-	1	1
4EC047.2	3	3	3	3	1	1	-	-	-	-	-	1	-	1	3
4EC047.3	3	2	3	1	1	1	-	-	1	-	1	1	2	1	3
4EC047.4	3	3	3	3	3	1	-	-	1	1	1	1	2	2	3
4EC047.5	3	3	3	3	3	3	1	1	1	1	1	1	3	3	3
4EC047.6	3	3	3	3	3	3	3	3	1	-	1	1	3	3	3
Average	3.0	2.8	3.0	2.5	2.2	1.7	2.0	2.0	1.0	1.0	1.0	1.0	2.5	1.8	2.7

Lab Resources:

- MCU/MPU kit: ARM mbed, ESP8266, Arduino, Wifi module.
- Keil IDE, Arduino IDE.
- Proteus Software
- Internet connectivity
- NI Labview
- NI ELVIS

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Programming and simulations.

Constituent COs in Assessment Tools :.

Sr. No	Course Outcomes	Assessment tools
1.	4EC47.1	**Exam, Viva, Assignments, Practical Performance, Project etc**
2.	4EC47.2	**Exam, Viva, Assignments, Practical Performance, Project etc**
3.	4EC47.3	**Exam, Viva, Assignments, Practical Performance, Project etc**
4.	4EC47.4	**Exam, Viva, Assignments, Practical Performance, Project etc**
5.	4EC47.5	**Exam, Viva, Assignments, Practical Performance, Project etc**
6.	4EC47.6	**Exam, Viva, Assignments, Practical Performance, Project etc**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	10	20

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

4EC48: Device Driver Development
Credits - 2 (L=2, T=0, P=1)

4th Year, B. Tech. (Electronics and Communication)

Course Objective:

To provide substantial practice with the key steps in developing Linux device drivers and how device drivers work, compile and load with the Linux kernel.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	2	30	20	20	30	100

Details of Assessment Instruments under CE Practical Component:

Term work [15]	Labwork [15]
File	Attendance/ lab work/viva

Course Content:

Unit. No.	Content	Teaching Hr.	Weightage
1.	**Review of Operating System:** Process ,Threads, Task, Concept of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Socket Functions, RPC Functions	2	15%
2.	**I/O and Memory management:** Linux: memory management - Physical and virtual (kernel and user) address spaces, Linux memory management implementation, I/O register and memory range registration, I/O register and memory access, Read / write memory barriers.	2	15%

3	**Configuring, compiling and booting the Linux kernel:** Kernel configuration, Native and cross compilation, Generated files, Booting the kernel, Kernel booting parameters, Mounting a root filesystem.	3	20%
4.	**Kernel Module Programming:** Static linking ,dynamic linking of modules, User space ,kernel space concepts, System calls like fork, exec, wait etc., Writing simple modules, Writing Makefiles for modules	3	20%
5.	**Character Device driver Development:** Driver concepts, Block & character driver distinction, Low level drivers, OS drivers etc, Writing character drivers, Device major, minor number, Interfaces to driver read, write, ioctl etc	3	20%
	Total	15	100%

List of References:

1. Robert Love, "*Linux Kernel Development*", 3rd Edition, Addison-Wesley Professional, June 2010
2. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman," *Linux Device Drivers*", 3rd Edition, O'Reilly, Feb. 2005
3. Daniel Bovet, Marco Cesati," *Understanding the Linux Kernel*", 3rd Edition, , O'Reilly, November 2005
4. Christopher Hallinan, "*Embedded Linux Primer -A Practical, Real-World Approach*", 2nd edition, Prentice Hall, November 2010 .
5. Sreekrishnan Venkateswaran,"*Essential Linux Device Drivers*",1st Edition, Prentice Hall, March 2008

Course Outcomes (Cos):

At the end of this course students will be able to

1. To familiar with the functions of Linux operating system
2. To learn Compile, install, run, and remove a live Linux source module.
3. To Design write, build, install, and run a specified custom module.
4. To understand how to configure, build, install and boot from a kernel.
5. To examine and use correctly the Linux kernel internal services needed by devices drivers
6. To analyze kernel debugging techniques with JTAG probes.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC48.1	1	2	-	3	-	-	-	-	-	-	-	-	3	-	2
4EC48.2	-	1	-	2	-	-	-	-	-	-	-	-	3	-	1
4EC48.3	-	-	1	2	-	-	-	-	-	-	-	-	3	-	1
4EC48.4	-	1	-	2	3	-	-	-	-	-	-	-	3	-	2
4EC48.5	1	1	-	2	-	-	-	-	-	-	-	-	3	1	2
4EC48.6	1	1	-	2	2	-	-	-	-	-	-	-	3	1	2
Average	0.5	1	0.167	2.167	0.83	0	0	0	0	0	0	0	3	0.33	1.67

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Laboratory: Performance of Experiments Using Linux OS

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1	4EC48.1	**Exam, Assignments, Presentation, Experiments**
2	4EC48.2	**Exam, Assignments, Presentation, Experiments**
3	4EC48.3	**Exam, Assignments, Presentation, Experiments**
4	4EC48.4	**Exam, Assignments, Presentation, Experiments**
5	4EC48.5	**Exam, Assignments, Presentation, Experiments**
6	4EC48.6	**Exam, Assignments, Presentation, Experiments**

List of Practical:

1. Introduction to linux and device driver
2. Introduction to UNIX commands
3. Write a program to print "hello world" linux kernel
4. Write a program using macros in linux kernel
5. Write a program using shell script
6. Demonstrating module_init & module_exit
7. Demonstrating _init, _initdata & _exit macros
8. Create n child processes in a chain sequence and also create unlimited number of child processes and check the limit.
9. Write a kernel program for loading two dynamic modules where one module depends on the other
10. Write a kernel program that passes the number of devices for a particular module as command line argument

11. Write a kernel program that prints the name of the process and its PID .
12. Write a program to run date, calendar and ls command using fork () and excel () system calls
13. Introduction to debugging techniques
14. Introduction to PCI drivers
15. Introduction to USB drivers

4EC49: Mobile Application Development
Credits - 2 (L=1, T=0, P=2)
4th Year, B. Tech. (*Electronics and Communication*)

Course Objective: To learn and develop the mobile applications on android platform.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
1	0	2	2	30	20	20	30	100

Details of Assessment Instruments under CE Theory Component

Internal Exams[10 Marks]	Continuous Assessment/ALA* [20 Marks]
Mid Sem Internal Exams	Attendance/Assignments /Quiz

***ALA: Active Learning Assignments**

Course Contents:

Unit No.	Topics	Teaching Hours	Weightage %
1	**Refresing OOP:** Object oriented programming concepts, java introduction, Abstract class and interface, Exceptional handling, Multithreading	(02+04=06)	10%
2	**Introduction to Android Programming and its Basics**: History, Features and android architecture, Introduction to java and android, Introducing development framework, Dalvik virtual machine – DVM, Installation of Android Studio, Android virtual device (AVD) and SDK manager, Android manifest file.	(03+05=08)	15%
3	**Android Building Blocks:** Types of android applications, Activity lifecycle, Intents, services, Content provider, broadcast receivers, Activity classes, Component lifecycle, Layouts,Views and Resources, Activity with Implicit Intents	(03+05=08)	20%
	Android User Interface :	(03+05=08)	

4	Buttons, RadioButtons, checkboxes, Pickers, Spinners, Menus: Optionsmenu, contex tual menu, Popup menu, Adding menu items, Navigation: Screen Navigation, navigation drawer, Theme and Styles: Uses of drawable in android		20%
5	**Database Connectivity:** SQLite database, SQLite data types, Cursors and content values, SQLite open helper, Adding, Updating and deleting content, Firebase database, connection of firebase database with android app	(03+05=08)	20%
6	**Test, Debug and Publishing and Other Moble Application Development:** Permission, Libraries, Widgets, Publishing your app, Making and publishing APK, iOS Platform Overview, basics iOS Dev Center, iOS SDK.	(01+06)	15%
	Total	45	100 %

Reference Books:

1. Bill Phillips,Chris Stewart, Kristin Marsicano, Brian Gardner, *"Android Programming: The Big Nerd Ranch Guide"*,4th Edition,Big Nerd Ranch Guide.
2. Dawn Griffiths,David Griffiths, *"Head First Android Development"*,2nd Edition, O'Reilly Media
3. Mike Wolfson, "*Android Developer Tools Essentials*", O'Reilly Media Publications..
4. Jeff Friesen, *"Learn Java for Android Development"*, A press Publications, 2nd Edition

Course Outcomes (COs):

By learning this course students will be able to

1. Understand Android OS,Android Studio platform for app development.
2. Understand the Android building blocks.
3. Apply the concept of UI in designing mobile application.
4. Analyze the database connectivity.
5. Design,Debug and publish the Android Application.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
4EC49.1	2	3	-	2	1	-	2	-	2	2	3	2	2	2	1
4EC49.2	1	3	-	2	1	-	2	-	2	2	2	2	2	2	1
4EC49.3	3	2	2	2	2	2	3	-	2	3	3	2	2	3	2
4EC49.4	2	2	-	2	2	-	1	-	2	3	3	2	2	2	1
4EC49.5	3	1	3	3	3	2	3	2	2	3	3	3	2	3	3

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14	PSO15
Average	2	2.2	1	2.2	1.8	0.8	2.2	0.4	2	2.8	2.8	2.2	2	2.4	1.6

Delivery Methods:

1. Lectures through Blackboard/ power-point slides, videos, pictures.
2. Hands on lab sessions for simulation on Android Studio.
3. Additional platfroms are Eclipse,Flutter

Constituent COs in Assessment Tools:

Sr. No	Course Outcomes	Assessment tools
1.	4EC49.1	**Exams, Assignments, Presentation**
2.	4EC49.2	**Exams, Assignments, Presentation**
3.	4EC49.3	**Exams, Assignments, Presentation**
4.	4EC49.4	**Exams, Assignments, Presentation**
5.	4EC49.5	**Exams, Assignments, Presentation, Mini Project**

Suggested specification table with marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	25	25	10	05

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate, C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

List of Experiments:

Sr. No	List
1	Study Android development toolkit.
2	Create a simple android app that displays a message "Hello World" in a textbox.
3	Create an Android App which has one activity to get Fernhit or Celsius. On Pressing "Convert" button it shows the Result will be displayed on Text View of Activity.
4	Create an Android App which has one activity to get two numbers N1 and N2. On Pressing "Button" has four operations for user to select as: 1.Add 2.Multiply 3.Divide 4.Substract. On selecting any one operation the Result should be displayed on Text view of Activity.

5	Create an Android App which has an activity to get details of a person like Name, Age(EditText), Gender(radioButton), Hobbies(CheckBox),BVM's student or not :(ToggleButton). On pressing send button second activity is launched which shows details entered in first activity.
6	Create an app which list of newspapers. When user selects one of them then it should show the newspaper via url in Browser or WebView.
7	Create an App which displays images in Grid view (two-dimensional scrolling grid rows & columns).
8	Create an app for widget toolbox.
9	Create an application for using Camera.
10	Create an application which activates and deactivates Bluetooth, finds the paired Bluetooth devices and scans for discovered Bluetooth devices
11	Create an application which enable and disable the wifi service.
12	Create an Application that use SQLLite Database for insert update and delete the user information.

ELECTRONICS & COMMUNICATION DEPARTMENT
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Gujarat, India

AGENDA ITEM No. 2: EC2021.1.2

AGENDA ITEM	DESCRIPTION
EC2021.1.2	To Discuss and Suggest the list of **Minor Degree** (Electronics and Communication Engineering) Courses. (Annexure – II).

Annexure – II

Proposed scheme for the award of Minor degree in Electronics and Communication Engineering Birla Vishvakarma Mahavidyalaya Engineering College [an autonomous institution]

Scheme of Teaching and Examination of Minor Specialization in Electronics and Communication.

Outline: A students needs to earn 20 credit to be eligible for getting Minor Degree in Electronics & Communication Engineering.

Requirements:

Sr. No.	Category	Minimum credits to be earned
1	1	8
2	2	8
3	3	4
	Total Credit	**20**

Category-I			
Sr. No	**Subject Code**	**Subject Title**	**Credits**
1	2EC02	ELECTRONIC DEVICES AND CIRCUITS	3
	2EC02	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	1

2	2EC11	CONTROL SYSTEMS	3
	2EC12	CONTROL SYSTEMS LABORATORY	1
3	2EC17	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	3
	2EC18	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION LABORATORY	1
4	2EC13	ANALOG COMMUNICATION	3
	2EC14	ANALOG COMMUNICATION LABORATORY	1
5	2EC09	SIGNALS AND SYSTEMS	3
	2EC10	SIGNALS AND SYSTEMS LABORATORY	1

Category-II			
1	2EC15	MICROPROCESSOR AND COMPUTER ARCHITECTURE	3
	2EC16	MICROPROCESSOR AND INTERFACING LABORATORY	1
2	3EC02	MICROCONTROLLER AND APPLICATIONS	3
	3EC03	MICROCONTROLLER AND APPLICATIONS LAB	1
3	3EC04	CMOS DIGITAL INTEGRATED CIRCUITS	3
	3EC05	CMOS DIGITAL INTEGRATED CIRCUITS LABORATORY	1
4	3EC42	DIGITAL SYSTEMS DESIGN USING HDL	4
5	2EC04	DIGITAL SYSTEM DESIGN	3
	2EC05	DIGITAL SYSTEM DESIGN LABORATORY	1

Category-III			
1	3EC06	DIGITAL COMMUNICATION	3
	3EC07	DIGITAL COMMUNICATION LABORATORY	1
2	3EC12	DIGITAL SIGNAL PROCESSING	3
	3EC13	DIGITAL SIGNAL PROCESSING LABORATORY	1
3	4EC43	RF and Microwave Engineering	4
4	3EC08	ANTENNA AND WAVE PROPAGATION	3
	3EC09	ANTENNAS AND WAVE PROPAGATION LABORATORY	1
5	4EC04	Wireless Communication	3
	4EC05	Wireless Communication Laboratory	1

Note: The students have to follow the academic regulation given by the organization and EC department for the award of a minor degree. See **Appendix-I** for the academic regulation by EC Department and **Appendix-II** for academic regulation by Institution.

APPENDIX-I

PROPOSED ACADEMIC REGULATIONS

For Awarding Undergraduate Degree with
MINOR in Electronics and Communication Engineering.

These rules shall be applicable to the students who are admitted to B.Tech. Degree program since Academic Year 2018-2019. They are prepared in line with the AICTE Model Curriculum – 2018. These regulations may be called "Academic Regulations (Minor) – UGM.18".

1. The student has to select the subjects declared by the Electronics and Communication department. From the given subjects, students have to acquire a **minimum of 20 credits** for the award of the minor degree within a stipulated time period.
2. From the subjects offered by the EC Department, students have to select a minimum of **two subjects from category-I and II** and Minimum **one Subject from Categroy-III.**
3. The **Sr. No. in each category** shows a number of subject students need to consider. Students have to select theory as well as practical subjects as per the Sr. No in each category. **One Sr. No. is equal to one subject for each category.**
4. If the students having the **equivalent/similar** subject offered in **regular/program elective/open elective in their respective branch**, they are **not eligible** to claim the similar subject for the minor degree.
5. Appropriate **MOOC Courses** are allowed for the credit transfer provided the contents of the MOOC courses **matches' minimum of 70 %** with the above-mentioned subjects. **Student needs to take prior permission** from the Board of Studies (BoS) of EC Department before selecting the MOOC Courses.

APPENDIX-II

PROPOSED **ACADEMIC REGULATIONS**
FOR AWARDING **UNDERGRADUATE** Degree with
MINOR (FULL TIME)

These rules shall be applicable to the students who are admitted to B.Tech. Degree program since Academic Year 2018-2019. They are prepared in line with AICTE Model Curriculum – 2018. These regulations may be called "Academic Regulations (Minor) – UGM.18".

UGM.18.1. **ELIGIBILITY**

A student will be eligible to get Undergraduate Degree with Minor (i.e. additional Minor Engineering) if he/she acquires an additional 20 credits. However, such additional Minor degree will be available only in the programmes offered by the departments of the institute.

UGM.18.2. **ENROLLMENT**

Students can enroll for B. Tech. Minor degree from 3rd to 8th semester of his / her B. Tech. Major degree and shall have a minimum CPI of 6.50 at the end of his/her 2nd semester of B.Tech. Major degree.

UGM.18.3. **COURSE CREDITS**

UGM.18.3.1. Credits can be obtained for Minor degree either through MOOCs and / or courses prescribed and offered by the respective Board of Studies for which he/she seeks enrollment for B. Tech. minor degree.

UGM.18.3.2. Credit for the online course will be awarded after successful completion of the MOOCs with certificate and/or valid score card with minimum 60 % of marks from offering institute.

UGM.18.3.3. Credit for the course which are offered by the BoS in which student has enrolled for B. Tech. minor degree will be awarded, if he/she obtains letter grade CC or better.

UGM.18.4. **CREDITS EARNED BY MOOCs**

The credits earned by the student through MOOCs shall be considered as per following:

Sr. No.	Duration of MOOCs Course	Equivalent Credits earned
1	12 weeks or more	04
2	08 weeks to 11 weeks	03
3	04 weeks to 07 weeks	02

UGM.18.5. **CREDITS TRANSFER**

On successful completion of the course the student will be awarded letter grade "AP" (Audit Pass), otherwise "AF" (Audit Fail) and the same will be reflected in transcript.

UGM.18.6. **REGISTRATION**

UGM.18.6.1. A student must register for the courses at the commencement of the semester along with the registration of his/her B. Tech. major degree registration.

UGM.18.7. **WITHDRAWAL**

UGM.18.7.1. A student can withdraw his/her course(s) registered for B. Tech. minor degree not later than six weeks of its registration.

UGM.18.7.2. A student can withdraw his/her enrollment for B. Tech. minor degree at any time before his/her 8^{th} semester of B. Tech. major degree end semester examination.

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Gujarat, India

AGENDA ITEM No. 3: EC2021.1.3

AGENDA ITEM	DESCRIPTION
EC2021.1.3	To approve the amendments made in the teaching and assessment scheme of the following three subjects of the **Third Level**. • 3EC81: Introduction to Cellular Communication • 3EC82: Applied Electronics • 3EC83: Embedded Systems and IoT (Annexure – III).

Annexure – III

Third Year Syllabus Structure

Semester – V

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1.	3HS01	Ethics and Constitution of India (Mandatory Non Credit Course – MC)	2	0	0	2	0
2.	3EC01	Electromagnetics Theory	3	0	0	3	3
3.	3EC02	Microcontroller and Applications	3	0	0	3	3
4.	3EC03	Microcontroller and Applications Lab	0	0	2	2	1
5.	3EC04	CMOS Digital Integrated Circuits	3	0	0	3	3
6.	3EC05	CMOS Digital Integrated Circuits Lab	0	0	2	2	1
		Programme Elective – I	3	0	2	5	4
7.	3EC41	Power Electronics					
8.	3EC42	Digital Design Using HDL					
9.	3EC43	Industrial Automation					
		Open Elective – I	3	0	0	3	3
10.	3EC81	Introduction to Cellular Communication					
11.	3EC82	Applied Electronics					
		Total	**17**	**0**	**6**	**23**	**18**

Semester VI

Sr. No.	Course Code	Name of Course	L	T	P	H	C
1.	3EC06	Digital Communication	3	0	0	3	3
2.	3EC07	Digital Communication Lab	0	0	2	2	1

3.	3EC08	Antennas and Wave Propagation	3	0	0	3	3
4.	3EC09	Antennas and Wave Propagation Lab	0	0	2	2	1
5.	3EC10	Advance Microcontroller	2	0	0	2	2
6.	3EC11	Advance Microcontroller Lab	0	0	2	2	1
7.	3EC12	Digital Signal Processing	3	0	0	3	3
8.	3EC13	Digital Signal Processing Lab	0	0	2	2	1
9.	3EC14	Scripting Languages	0	0	2	2	1
		Programme Elective – II	3	0	0	3	3
10.	3EC44	Introduction to Real Time Operating System					
11.	3EC45	Optical Fiber Communication					
12.	3EC46	Satellite Communication					
		Open Elective – II	3	0	2	5	4
13.	3EC83	Embedded Systems and IOT					
		Total	**17**	**0**	**12**	**29**	**23**

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3EC81: INTRODUCTION TO CELLULAR COMMUNICATION

CREDITS - 3 (LTP: 3, 0, 0)

3rd Year, B. Tech. (*Electronics and Communication*)

Course Objective:

To understand the concept of mobile communication, frequency reuse, wireless model, GSM & CDMA network, various wireless protocols & its applications related to mobile communication.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Contents :

Unit No.	Topics	Teaching Hours
1.	**Evolution of Mobile Communication Systems :** Introduction-base station, mobile station, MSC, forward and reverse channel, control channel, Paging system, Cordless telephone system, Cellular telephone system, Advantages and disadvantages of mobile communications, Comparison of wireless systems, applications of wireless communications.	04
2.	**Cellular Concept – System Design Fundamentals :** Introduction, frequency reuse, channel assignment strategies, handoff strategies, umbrella cell concept, interference and system capacity, co-channel and adjacent channel interference, cell splitting, sectoring, microcell zone concept.	06
3.	**Mobile Communication Engineering :** Introduction, Radio paths, Propagation attenuation, Basic propagation mechanisms, mobile radio channel, simulation of wireless fading channels, free space propagation model, outdoor propagation model.	08
4.	**GSM & CDMA Systems :** GSM network architecture, GSM signaling protocol architecture, Identifier used in GSM systems, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM handoff procedures, GSM services and features, Concept of spread spectrum, CDMA architecture.	12

Unit No.	Topics	Teaching Hours
5.	**3G and 4G Digital Mobile Technology :** 2.5G TDMA evolution path, GPRS technology, EDGE technology, 2.5G CDMA technology, Need of 3G and 4G mobile networks, IMT-2000 Global standards, UMTS technology, W-CDMA air interface, TD-SCDMA technology, CDMA 2000 technology. 4G-LTE.	09
6.	**Emerging Wireless Network Technologies :** IEEE 802.11 WLAN technology, IEEE 802.15 WPAN technology, IEEE 802.16 WMAN technology, Mobile adhoc networks (MANETs), Wireless sensor networks, RFID technology, IEEE 802.21 standards overview, Case studies of latest wireless technologies.	06
	Total	45

List of References :

1. T. L. Singal, *"Wireless Communications"*, Tata McGraw Hill , 2nd Edition, 2011.
2. T. S. Rappaport, *"Wireless Communications: Principles and practice"*, Pearson, 2nd Edition, 2010.
3. A. Goldsmith, "*Wireless Communications*", Cambridge university press, 1st Edition, 2005.
4. B. Razavi, "*RF Microelectronics"*, Prentice Hall, 1st Edition, 1998.
5. W.C.Y. Lee, *"Mobile Communications Engineering"*, McGraw Hill Telecomm., 2nd Edition, 1998.

Course Outcomes (COs) :

By learning this course students will be able to …

1. Understand the basics of mobile communication systems.
2. Design the cellular system and improve the coverage and capacity of system.
3. Analyze and design the various mobile propagation model.
4. Design GSM and CDMA wireless networks.
5. Study the 3G and 4G digital mobile technology.
6. Compare the recent emerging protocol of wireless communication system.

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3EC82: Applied Electronics
CREDITS - 3 (LTP: 3, 0, 0)
3rd Year, B. Tech. (*Electronics and Communication*)

Course Objective :
The basics of applications based electronics fundamentals are covered for the students of different braches other than electronics and communication.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content :

Unit No.	Topics	Teaching Hours
1.	**Operational Amplifiers :** Ideal operational amplifier, Operational amplifier Stages, Operational amplifier parameters, Equivalent circuit of op-amp, Ideal Voltage transfer Curve, Open-Loop Op-amp configurations, Closed-Loop op-amp configurations	06
2.	**555 Timer Circuits :** Block diagram, Use as Astable multivibrator and monostable multivibrator	04
3.	**Transducers :** Capacitive Transducer, Inductive Transducer, Linear Variable Differential Transformer, Oscillation Transducer, Potentiometric transducer, Electrical strain gauges, Resistance thermometer, Thermistor, Thermocouple, Piezoelectric Transducer, Photoelectric transducer	07
4.	**Introduction to Electronics Communication :** The significance of Human Communication, Communication systems, Types of Electronics Communication, Modulation and Multiplexing, The electromagnetic Spectrum, Bandwidth	06
5.	**Optoelectronic Devices :** Photoconductive sensors, Photovoltaic sensors, Photo emissive sensors, Light emitters, Liquid Crystal Display, Opto-coupler	07
6.	**Memories and Microcontroller :** Introduction to semiconductor memories, The AVR microcontrollers' history and features, AVR architecture ,AVR programming in C.	07

7.	**Consumer Electronics :** Washing machines (Electronic Controller, Fuzzy logic machines and automatic washing Machines), Audio systems, I-pods, RFID, Barcode Scanner and decoder, Photocopier machines, Introduction to organic electronics and internet of things (Industry 4.0)	08
	Total	45

List of References :

1. S Salivahanans, N Kumar, A Vallavaraj, "*Electronic devices and circuits*",2nd Edition, McGraw Hill,2008
2. Santiram KAL, "*Basic Electronics Devices, Circuits and its Fundamentals*",5th Edition, PHI Publication,2006
3. M.A. Mazidi,Sarmad Naimi,Sepehr Naimi, "*The AVR Microcontroller & Embedded Systems using Assembly and C*",1st Edition, Pearson Education,2011.
4. Louis E. Frenzel, "*Principles of Electonic Communication Systems*",3rd Edition, McGraw Hill Publication,2014
5. Alasdair Gilchrist, " *Industry 4.0* ", Apress, 2016

Course Outcomes (COs) :

1. Understand the fundamental s of Operational amplifier and its applications.
2. Analyze and able to design sensor based applications.
3. Understand the Principles of Electronics Communication.
4. Understand and able to analyze Modern Communication systems and its applications.
5. Able to use of the CAD tools and programming of AVR on C platform.
6. Design and understands the various modern electronics based real time industrial applications.

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3EC83: EMBEDDED SYSTEMS AND IOT

CREDITS – 4 (LTP:3,0,2)

3rd Year, B. Tech. (*Electronics & Communication*)

Course Objective:

Understand and Design Arduino based embedded systems for branch specific applications. Understand and Integrate IoT Platforms to enhance application metrics and accessibility.

Teaching and Assessment Scheme :

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Content :

Unit No.	Topics	Teaching Hours
1.	**Introduction :** Numbering and coding systems, semiconductor memory, CPU architecture, Microcontrollers and Microprocessors, embedded system, Introduction to Arduino Uno and Arduino IDE, Structuring an Arduino Program, Using data types and operations.	04
2.	**IO Port Programming :** Atmega328p pins and functions, IO port programming, Using a Switch, Reading a Keypad, Visual Output, Connecting and Using LEDs, Driving a 7-Segment LED Display, LCD Display.	07
3.	**Serial Communication :** Introduction to serial communication, Sending Formatted Text and Numeric Data from Arduino, Sending and Receiving Serial Data in Arduino, GSM modem, Bluetooth.	07
4.	**Getting Input from Sensors :** Reading Analog Values, Detecting Light, Detecting Motion (Integrating Passive Infrared Detectors), Measuring Distance, Detecting Vibration, Detecting Sound, Measuring Temperature, Reading RFID Tags, Tracking Rotary Movement, Detecting Acceleration.	09
5.	**Physical Output :** Controlling a Servo, driving a Brushless Motor, Controlling Solenoids and Relays, making an Object Vibrate, Controlling the Direction and Speed of a Motor with an H-Bridge, Driving a Stepper Motor.	08

Unit No.	Topics	Teaching Hours
6.	**Introduction to IoT :** Defining IoT, Characteristics of IoT, design of IoT, Functional blocks of IoT, Communication models & APIs, IOT platforms. ESP8266-Introduction. Domain specific applications of IoT : Home automation, Industry applications, Environmental applications.	10
	Total	45

List of References :

1. Michael Margolis, "*Arduino Cookbook*", First Edition, O'Reilly Media, March 2011.
2. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, "*The AVR Microcontroller and Embedded Systems: Using Assembly and C*", 1st Edition, Pearson Education, 2012.
3. Michael McRoberts, "*Beginning Arduino*", 2/E, Apress, 2013
4. Cornel Amariei, "*Arduino Development Cookbook*", Packt Publishing, 2019.
5. Michael McRoberts, "*Beginning Arduino*", Second Edition, Apress, 2013
6. Marco Schwartz, "*Internet of Things with ESP8266*", Packt Publishing Ltd., July 2016
7. Marco Schwartz, "*ESP8266 Internet of Things Cookbook*", Packt Publishing, 2017

Course Outcomes (COs) :

At the end of this course students will be able to …

1. Recollect basic knowledge about Digital Systems and microcontroller architecture.
2. Understand functions of Arduino pins and illustrate its use.
3. Integrate serial communication for device interfaces and debugging in applications.
4. Make use of sensors for monitoring different quantities in application.
5. Integrate actuators in application for physical movement and control.
6. Understand concepts of IoT and design IoT applications.

Chairman, EC BoS
Dr. B. C. Goradiya

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