COURSE STRUCTURE

I SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17FE01	Professional Communication-I	3	-	-	3	3	40	60	100
2	17FE04	Differential Equations and Linear Algebra	3	2	-	5	4	40	60	100
3	17FE15	Engineering Chemistry	4	-	-	4	4	40	60	100
4	17EC01	Electrical Circuits and Networks	2	2	-	4	3	40	60	100
5	17EC02	Electronic Devices and Circuits	2	2	-	4	3	40	60	100
6	17FE65	Engineering Chemistry Lab	-	-	2	2	1	40	60	100
7	17EC60	Electrical Circuits and Networks Lab	-	-	2	2	1	40	60	100
8	17ME75	Computer Aided Engineering Drawing Lab	1	-	2	3	2	40	60	100
9	17EC61	Electronic Devices and Circuits Lab	-	-	2	2	1	40	60	100
		Total	**15**	**6**	**8**	**29**	**22**	**360**	**540**	**900**

II SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17FE02	Professional Communication-II	3	-	-	3	3	40	60	100
2	17FE06	Transformation Techniques and Vector Calculus	3	2	-	5	4	40	60	100
3	17FE12	Applied Physics	3	2	-	5	4	40	60	100
4	17EC03	Analog Electronic Circuits	2	2	-	4	3	40	60	100
5	17EC04	Digital Electronic Circuits	2	2	-	4	3	40	60	100
6	17FE60	English Communication Skills Lab	-	-	2	2	1	40	60	100
7	17FE62	Applied Physics Lab	-	-	2	2	1	40	60	100
8	17ME60	Engineering Workshop	1	-	2	3	2	40	60	100
9	17EC62	Analog and Digital Electronic Circuits Lab	-	-	2	2	1	40	60	100
		Total	**14**	**8**	**8**	**30**	**22**	**360**	**540**	**900**

III SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17FE07	Numerical Methods and Fourier Analysis	3	2	-	5	4	40	60	100
2	17CI01	Computer Programming	2	2	-	4	3	40	60	100
3	17EC05	Signals and Systems	2	2	-	4	3	40	60	100
4	17EC06	Random Variables and Stochastic Processes	2	2	-	4	3	40	60	100
5	17EC07	Pulse and Switching Circuits	2	2	-	4	3	40	60	100
6	17EC08	Analog Integrated Circuits	2	2	-	4	3	40	60	100
7	17CI60	Computer Programming Lab	-	-	2	2	1	40	60	100
8	17EC63	Pulse and Switching Circuits Lab	-	-	2	2	1	40	60	100
9	17EC64	Analog Integrated Circuits Lab	-	-	2	2	1	40	60	100
10	17PD03	Professional Ethics and Human Values	3	-		3	0	40	60	100
11	17PD01	Problem Assisted Learning	-	-	1	1	0	100		100
		Total	**16**	**12**	**7**	**35**	**22**	**500**	**600**	**1100**

IV SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17FE03	Environmental Science	3	-	-	3	3	40	60	100
2	17FE09	Functions of Complex Variables	3	2	-	5	4	40	60	100
3	17EC09	Electromagnetic Fields and Waves	2	2	-	4	3	40	60	100
4	17EC10	Digital Signal Processing	2	2	-	4	3	40	60	100
5	17EC11	Digital System Design	2	2	-	4	3	40	60	100
6	17EC12	Analog Communications	2	2	-	4	3	40	60	100
7	17EC65	Digital Signal Processing Lab	-	-	2	2	1	40	60	100
8	17EC66	Digital System Design Lab	-	-	2	2	1	40	60	100
9	17EC67	Analog Communications Lab	-	-	2	2	1	40	60	100
10	17PD02	Problem Based Learning	-	-	1	1	0	100	-	100
		Total	**14**	**10**	**7**	**31**	**22**	**460**	**540**	**1000**

V SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17HS01	Engineering Economics and Accountancy	3	-	-	3	3	40	60	100
2	17EC13	Computer Organization and Architecture	3	-	-	3	3	40	60	100
3	17EC14	Transmission Lines and Wave Guides	2	2	-	4	3	40	60	100
4	17EC15	Digital Communications	2	2	-	4	3	40	60	100
5	17EC16	VLSI Design	3	-	-	3	3	40	60	100
6	**PROGRAM ELECTIVE-I**		3	-	-	3	3	40	60	100
	17EI18	Micro Electro Mechanical Systems								
	17EC17	PCB Design								
	17EC18	Advanced Communications								
	17EC19	Advanced Digital Signal Processing								
7	17EC90	Electronic Measurements and Instrumentation **(*Add on course – I)**	3	-	-	3	3	40	60	100
8	17EC68	Digital Communications Lab	-	-	2	2	1	40	60	100
9	17EC69	VLSI Design Lab	-	-	2	2	1	40	60	100
10	17PD04	Mini Project	-	-	4	4	2	100	-	100
11	17PD05	Employability Enhancement Skills-I	1	-	-	1	0	100	-	100
12	17PD06	Industrial Training/ In-house Training	-	-	-	-	-	-	-	-
		Total	**20**	**4**	**8**	**32**	**22/25***	**560**	**540**	**1100**

VI SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17EC20	Linear Control Systems	2	2	-	4	3	40	60	100
2	17CI07	OOPs through Java	3	-	-	3	3	40	60	100
3	17EC21	Antenna and Wave Propagation	2	2	-	4	3	40	60	100
4	17EC22	Microprocessors and Microcontrollers	3	-	-	3	3	40	60	100
5	**PROGRAM ELECTIVE - II**		3	-	-	3	3	40	60	100
	17EC23	Nano Electronics								
	17EC24	Low Power VLSI Design								
	17EC25	Cellular and Mobile Communications								
	17EC26	Transform Techniques								
6	**OPEN ELECTIVE - I**		3	-	-	3	3	40	60	100
7	17FE61	Presentation Skills Lab	-	-	2	2	1	40	60	100
8	17EC91	Telecommunication SwitchingSystems and Networks **(*Add on course – II)**	3	-	-	3	3	40	60	100
9	17CI65	OOPs through Java Lab	-	-	2	2	1	40	60	100
10	17EC70	Microprocessors and Microcontrollers Lab	-	-	2	2	1	40	60	100
11	17PD07	Seminar	-	-	2	2	1	100		100
12	17PD08	Employability Enhancement Skills-II	1	-	-	1	0	100	-	100
		Total	**20**	**4**	**8**	**32**	**22/25***	**600**	**600**	**1200**

VII SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17EC27	Microwave Engineering	2	2	-	4	3	40	60	100
2	17EC28	Optical Communications	2	2	-	4	3	40	60	100
3	17EC29	Embedded System Design	3	-	-	3	3	40	60	100
4	**PROGRAM ELECTIVE-III**		3	-	-	3	3	40	60	100
	17EC30	Automobile and Consumer Electronics								
	17EC31	Analog VLSI Design								
	17EC32	Satellite Communications								
	17EC33	Digital Image Processing								
5	**PROGRAM ELECTIVE-IV**		3	-	-	3	3	40	60	100
	17EC34	Medical Electronics								
	17EC35	Advanced Microcontrollers								
	17EC36	Mobile Computing								
	17EC37	DSP Processors								
6	**OPEN ELECTIVE-II**		3	-	-	3	3	40	60	100
7	17EC92	Communication Networks **(*Add on course– III)**	3	-	-	3	3	40	60	100
8	17EC71	Microwave and Optical Communications Lab	-	-	2	2	1	40	60	100
9	17EC72	Embedded System Design Lab	-	-	2	2	1	40	60	100
10	17PD09	Internship	-	-	1	1	2	100	-	100
11	17PD10	Extra-curricular/Co-curricular Activities	-	-	1	1	-	-	-	-
		Total	**19**	**4**	**6**	**29**	**22/25***	**460**	**540**	**1000**

VIII SEMESTER

S.No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	**PROGRAM ELECTIVE-V**		3	-	-	3	3	40	60	100
	17EC38	Programmable Logic Devices								
	17EC39	Real Time Operating Systems for Embedded Systems								
	17EC40	Radar Systems								
	17EC41	Neural Networks and Fuzzy Control								
2	**PROGRAM ELECTIVE - VI**		3	-	-	3	3	40	60	100
	17EC42	Radio Frequency Integrated Circuits								
	17EC43	Design for Internet of Things								
	17EC44	Wireless Sensor Networks								
	17EC45	Bio Medical Signal Processing								
3	**OPEN ELECTIVE-III**		3	-	-	3	3	40	60	100
4	17PD11	Project Work	-	-	24	24	12	40	60	100
5	17PD12	Comprehensive Viva-Voce	-	-	2	2	1	100	-	100
		Total	**9**	**-**	**26**	**35**	**22**	**260**	**240**	**500**

OPEN ELECTIVE – I (VI Semester)

S.No.	Course Code	Title of the Course	Offered by	Chosen by
1	17MB80	Industrial Engineering and Management	MBA	AE, CE, CSE, ECE, EEE, EIE & IT
2	17MB81	Project Management	MBA	AE, CE, CSE, ECE, EEE, EIE, IT & ME
3	17MB82	Logistics and SupplyManagement	MBA	AE, CE, CSE, ECE, EEE, EIE, IT & ME
4	17MB83	Banking and InsuranceManagement	MBA	AE, CE, CSE, ECE, EEE, EIE, IT & ME

OPEN ELECTIVE – II (VII Semester)

S.No.	Course Code	Title of the Course	Offered by	Chosen by
1	17AE80	Principles of Flight	AE	CE, CSE, ECE, EEE, EIE, IT & ME
2	17CE80	Basic Civil Engineering	CE	AE, CSE, ECE, EEE, EIE, IT & ME
3	17CS80	Java Programming	CSE	AE, CE, ECE, EEE, EIE & ME
4	17CS81	Introduction to Operating Systems	CSE	AE, CE, ECE, EEE, EIE & ME
5	17EC80	Satellite Technology	ECE	AE, CE, CSE, EEE, EIE, IT & ME
6	17EC81	Analog and Digital Communications	ECE	AE, CE, CSE, EEE, IT & ME
7	17EE80	Basic Control Systems	EEE	AE, CE, CSE, IT & ME
8	17EE81	Utilization of Electrical Energy	EEE	AE, CE, CSE, ECE, EIE, IT & ME
9	17EI80	Instrumentation Technology	EIE	AE, CE, CSE, ECE, EEE, IT & ME
10	17IT80	Introduction to Database	IT	AE, CE, ECE, EEE, EIE & ME
11	17ME80	Optimization Techniques	ME	AE, CE, CSE, ECE, EIE & IT
12	17ME81	Elements of AutomobileEngineering	ME	AE, CE, CSE, ECE, EEE, EIE, & IT

OPEN ELECTIVE – III (VIII Semester)

S.No.	Course Code	Title of the Course	Offered by	Chosen by
1	17AE81	Space Technology	AE	CE, CSE, ECE, EEE, EIE, IT & ME
2	17CE81	Disaster Management	CE	AE, CSE, ECE, EEE, EIE, IT & ME
3	17CS82	Internet Technologies	CSE	AE, CE, ECE, EEE, EIE & ME
4	17CS83	Shell Programming	CSE	AE, CE, ECE, EEE, EIE & ME
5	17EC82	Elements of Communication Systems	ECE	AE, CE, CSE, IT & ME
6	17EC83	Systems and Signal Processing	ECE	AE, CE, CSE, IT & ME
7	17EE82	Energy Auditing	EEE	AE, CE, CSE, ECE, EIE, IT & ME
8	17EE83	Renewable Energy Sources	EEE	AE, CE, CSE, ECE, EIE & IT
9	17EI81	Nano Technology	EIE	AE, CE, CSE, ECE, EEE, IT & ME
10	17IT81	Computer Networks	IT	AE, CE, EEE & ME
11	17ME82	Robotics and Automation	ME	AE, CE, CSE, ECE, EEE & IT
12	17ME83	Mechanical Handling Systems and Equipments	ME	AE, CE, CSE, ECE, EEE, EIE & IT

B.Tech. (I Sem.)	17FE01 - PROFESSIONAL COMMUNICATION – I	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Basics in English Grammar & Vocabulary

Course Educational Objective:
To improve the proficiency of students in English with an emphasis on Vocabulary& Grammar for better communication in formal and informal situations;Develop listening skills required for thorough understanding and analysis to face interviews with confidence.

Course Outcomes: At the end of the course, the student will be able to
CO1: Use English vocabulary & grammar effectively while speaking and writing.
CO2: Comprehend the given text and Communicate confidently in formal and informal contexts.
CO3: Draft E-mails & Memos
CO4: Understand the written and spoken information thoroughly.
CO5: Face interviews with confidence.

UNIT – I
Presidential Address – Dr. A.P.J. Abdul Kalam
Vocabulary: Word formation: Prefixes, suffixes & Compound Collocations
Grammar: Punctuation; Parts of Speech
Reading: Double Angels, David Scott
Writing: Sentence structure; Paragraph writing& Dialogue writing

UNIT – II
SatyaNadella's E-Mail to his Employees
Vocabulary: Homonyms, Homophones, Homographs (Words often confused)
Grammar: Types of verbs; Types of sentences
Reading: The Road Not Taken – Robert Frost
Writing: Letter Writing: Official Letters

UNIT – III
Technology with a Human Face – E.F.Schumacher
Vocabulary: Synonyms & Antonyms, commonly misspelt words
Grammar: Tenses: Types & Uses
Reading: Extract from 'Preface' to Lyrical Ballads – William Wordsworth
Writing:E-mails; Memo drafting

UNIT – IV
Listening Skills: The boy who broke the bank – Ruskin Bond; Importance of active listening; understanding the people; understanding places &events;expanding the proverbs on listening& listening at work place.

UNIT – V
Interview Skills: The lighthouse keeper of Aspinwall – Henryk Sienkiewicz; Interview skills from the story; expanding proverbs on Interview skills; Tips for attending an Interview - Covering letters for job applications & Writing a CV/Résumé

TEXT BOOKS

1 Board of Editors, "Fluency in English – A Course book for Engineering Students", Orient Black Swan, Hyderabad, 2016
2 Dhanavel S.P, "English and Soft Skills", Orient Black Swan, Hyderabad, 2010.

REFERENCE

1. Murphy, "English Grammar with CD", Cambridge University Press, New Delhi, 2004.
2. Rizvi Ashraf M., "Effective Technical Communication", Tata McGraw Hill, New Delhi, 2008
3. BaradwajKumkum, "Professional Communication", I.K.International Publishing House Pvt.Lt., New Delhi, 2008.
4. Raman, Meenakshi and Sharma, Sangeeta, . "Technical Communication -Principles and Practice".Third Edition. New Delhi: Oxford University Press. 2015.

B.Tech.(ISem.)

17FE04- DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

L	T	P	Cr.
3	2	-	4

Pre-requisites : Basics of Differential Calculus and Matrix Algebra

Course Educational Objective :
The objective of this course is to introduce the first order and higher order differential equations, functions of several variables. The students will also learn Matrix Algebra.

Course Outcomes : At the end of the course, the student will be able to :

CO1: Apply first order and first degree differential equations to find Orthogonal trajectories and to calculate current flow in a simple LCR circuit.
CO2: Discriminate among the structure and procedure of solving a higher order differential equations with constant coefficients and variable coefficients.
CO3: Developing continuous functions as an infinite series and compute the Jacobian to determine the functional dependence.
CO4: Distinguish among the pros and cons between the Row operation methods and Iterative methods in solving system of linear equations.
CO5: Compute the Eigen values and Eigen vectors and powers, Inverse of a square matrix through Cayley – Hamilton theorem.

UNIT –I
Differential Equations of First Order and First Degree
Differential equations of first order and first degree – Exact and Non Exact Differential Equations, Applications to Orthogonal trajectories, Newton's Law of Cooling and Law of Growth and Decay.

UNIT –II
Higher Order Differential Equations
Linear differential equations of second and higher order with constant coefficients, method of variation of parameters.

UNIT – III
Functions of Several variables
Generalized Mean Value Theorem (without proof), Maclaurin's series, Functions of several variables, Jacobians (polar, cylindrical, spherical coordinates), Functional dependence.
Partial Differential Equations.
Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions.Solution of first order and first degree linear partial differential equation – Lagrange's method.

UNIT –IV
System of Linear Equations.
Matrices - Rank- Echelon form, Normal form, PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non Homogeneous system of equations

UNIT – V
Eigen Values and Eigen Vectors
Eigen values – Eigen Vectors – Properties – Cayley Hamilton Theorem – Inverse and Powers of a matrix by using Cayley Hamilton Theorem.

TEXT BOOKS:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH Publications, New Delhi, 2010.

REFERENCE BOOKS:

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi, 2011.
2. Erwin Krezig, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley &Sons, New Delhi, 2011.
3. W. E. Boyce and R. C. Diprima, "*Elementary Differential equations*", 7th Edition, John Wiley and sons, New Delhi, 2001.

B.Tech. (I Sem.) **17FE15 – ENGINEERING CHEMISTRY**

L	T	P	Cr.
4	-	-	4

Pre-requisites: Knowledge of galvonic cell, working principle of battery, concept of polymerization,qualitative and quatitative analysis.

Course Educational Objectives :

To impart knowledge on various types of electro chemical energy systems, corrosion prevention methods and characteristics of various engineering materials.

To enable the students to obtain knowledge on photo chemical processes, liquid crystals, analytical and spectroscopic techniques of chemical analyses.

Course Outcomes : At the end of the course, the student will be able to :

CO1: Analyze different types of electrodes and batteries for technological applications.

CO2: Apply the principles of corrosion in order to maintain various equipments more effectively.

CO3: Identify the importance of engineering materials like nano materials, plastics and rubbers.

CO4: Analyze various photo chemical processes & applications of liquid crystals.

CO5: Identify the importance of analytical and spectroscopic techniques in chemical analyses.

UNIT – I

ELECTRO CHEMISTRY & BATTERIES

Introduction: Electrode potential, standard reduction and oxidation potentials (S.R.P and S.O.P), E.M.F/cell potential of a cell.

Nernst equation: Derivation and problems.

Reference Electrode: Standard hydrogen electrode (S.H.E), calomel electrode, measurement of electrode potential, electro chemical series and applications.

Types of batteries: Primary, secondary and reserve batteries, dry battery(Leclanche cell), Nickel-Cadmium battery, Magnesium - Copper reserve battery.

Fuel Cells: Hydrogen- Oxygen fuel cells.

UNIT – II

SCIENCE OF CORROSION

Introduction: Definition, Examples.

Dry Corrosion (Direct Chemical corrosion): Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases and liquid metal corrosion.

Wet Corrosion (Electro Chemical corrosion): Mechanism- oxygen absorption, hydrogen evolution, types of wet corrosion, Galvanic Corrosion, Concentration Cell Corrosion, passivity and Galvanic series.

Factors Influencing Corrosion: Nature of metal (Purity, position in galvanic series, relative area of cathode & anode, nature of surface film) and nature of environment(temperature, humidity, atmospheric pollution and nature of ions in the medium).

Control of Corrosion: Cathodic Protection - Sacrificial anode and impressed current methods, electro plating and metal cladding.

UNIT – III

CHEMISTRY OF ENGINEERING MATERIALS

Nano Materials: Introduction, definition, properties (optical, electrical, mechanical magnetic) preparation of nano materials-sol-gel method and applications of nano materials.

Polymers: Definition, basic terminology, diferences between thermosets &thermoplasts, types of polymerization(addition,condensation and copolymerisation), preparation, properties and

engineering applications of bakelite and PMMA, conducting polymers- extrensic, intrensic conducting polymers and fiber reinforced plastics (FRP).
Rubbers: Definition, processing of natural rubber and drawbacks, vulcanization - advantages, preparation, properties and applications of BUNA-S and thiokol.

UNIT – IV
PHOTO CHEMISTRY & LIQUID CRYSTALS
Introduction: Definition, differences between thermal and photo chemical reactions.
Laws of Photo Chemistry: Grothers-Droper law, Stark-Einstein law and quantum efficiency(Definition only).
Photo Physical processes: Fluorescence, phosphorescence – applications, chemiluminiscence, bio-luminescence and Photo-sensitization.
Liquid crystals: Definition, identification and structural aspects of molecules to form liquid crystals.
Classification of liquid crystals: Thermo tropic liquid crystals and types, lyotropic liquid crystals and applications.

UNIT – V
ANALYTICAL TECHNIQUES
Introduction: Types of analysis.
Physical analysis: Analysis of physical characteristics.
Chemical analysis: Gravimetric and volumetric analysis (basic concept only).
Instrumental analysis: Electro analytical techniques – Introduction.
Conducto metric techniques:strong acid -strong baseand strong acid-weak base, weak acid - strong base and weak acid -weak base – advantages.
Potentiometrictechniques: Acid-base and oxidation-reduction titrations-advantages.
Colorimetrictechniques: Principle and determination of iron by using thiocynate as a reagent.

SPECTROSCOPY
Introduction: Origin of electronic spectra, types of spectra-emission and absorption spectra and Beer-Lambert's law.
IR-Spectroscopy: Types of vibrations, factors influencing vibrational frequencies and applications of IR-Spectroscopy.
UV-Spectroscopy: Types of electronic transitions, probability, Chomophores, Auxochromes and applications of UV-Spectroscopy.

TEXT BOOKS
1. Shikha Agarwal, "A Text book of Engineering Chemistry", Cambridge University Press, New Delhi, 1st Edition, 2015.
2. Jain, Jain, "A textbook of Engineering Chemistry",Dhanpat Rai Publicating Company, New Delhi, 16th Edition, 2015.

REFERENCES
1. Shashi Chawla, "A Text book of Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 3rd Edition, 2003.
2. S.S. Dara, S.S. Umare, "A Text book of Engineering Chemistry",S.Chand Publications, New Delhi, 12th Edition, 2010.
3. Y. BharathiKumari and Jyotsna Cherukuri, "A Text book of Engineering Chemistry", VGS Publications, Vijayawada, 1st Edition,2009.

B.Tech. (I-Sem.)	17EC01 – ELECTRICAL CIRCUITS AND NETWORKS	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Differential equations, Partial differential equations& Integrals.

Course Educational Objective : This course discuss basic electrical quantities and learn about basic elements and their properties, general analysis techniques that can be applied to arbitrary circuits. After taking this course, one should be able to analyze any linear circuit.

Course Outcomes: At the end of the course, the student will be able to:

- **CO1:** Understand the concepts of two-port network parameters
- **CO2:** Analyze various parameters of magnetically coupled circuits.
- **CO3:** Evaluate the parameters and transient behavior of electrical circuits.
- **CO4:** Design various tuned circuits using electronic communication.

UNIT – I

Electrical Circuit Fundamentals: Passive elements, active elements, Ohm's Law, independent and dependent sources,voltage-current relationship for passive elements, Kirchhoff's laws,voltage and current division methods,star-to-delta and delta-to-star transformation,source transformation,mesh analysis, nodal analysis, duality and dual networks.

Network Topology: Definitions of graph, tree, branch, link orchord, twig; Tie- Set and Cut-Set analysis of networks with independent voltage and current sources.

UNIT – II

AC Fundamentals: R.M.S value, Average value, form factor and Peak factor for different periodic wave forms, reactance, impedance, susceptance and admittance, behavior of pure resistor, pure inductor and capacitor in AC circuit, steady state analysis of RLC circuits with sinusoidal excitation,concept of power factor, active, reactive and complex power, power triangle.

Magnetic Circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coupled circuits, coefficient of coupling, analysis of series and parallel magnetic circuits.

UNIT – III

Resonant circuits: Series and parallel resonant circuits, concept of band width, quality factor and selectivity.

Network Theorems: Superposition, Thevenin's, Norton's, Maximum power transfer, reciprocity and Milliman's theorems.

UNIT – IV

Transient Analysis (both AC and DC networks): Initial conditions of RLC elements, transient response of series RL, RC and RLC circuits, solution using differential equation approach and Laplace transforms.

UNIT – V

Two-Port Networks: Z,Y, ABCD & h-parameters,Inter-relationship between parameters,Two port network connections in series, parallel and cascaded.

Network Functions: Complex frequency, driving point and transfer functions, properties of driving point and transfer functions, poles and zeros of network functions.

TEXT BOOKS

1. W H Hayt,J E Kemmerly, S M Durbin, "Engineering Circuit Analysis", McGraw Hill Education Pvt.Ltd, 7th edition,2007
2. M.E. Van Valkenburg, "Network Analysis", PHI Learning Pvt Ltd, 3rd edition,1980

REFERENCES

1. James W Nilsson,SusanA.Riedel, "Electric Circuits", Pearson Education,8th edition, 2004
2. Charles K.Alexander,MatthewN.O.Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education Pvt.Ltd, 5th edition,
3. A Sudhakar,Shyammohan S Palli, "Circuits and Networks,Analysis and Synthesis", McGraw Hill Education Pvt Ltd,7thEdition,New Delhi
4. Ravish R Singh, "Network Analysis and synthesis", Tata McGraw Hill Pvt Ltd, New Delhi.
5. Smarajith Ghosh, "Network Theory,Analysis and Synthesis", PHI Learning Pvt Ltd, New Delhi,2015
6. Abhijit Chakrabarti, "Circuit Theory, Analysis and Synthesis",Dhanpat Rai & Co.,6th edition,2004

B.Tech. (I-Sem.) 17EC02 – ELECTRONIC DEVICES AND CIRCUITS	L	T	P	Cr.
	2	2	-	3

Pre-requisites : Fundamentals of Physics.

Course Educational Objective:
This course gives an overview of carrier transport phenomena in semiconductor, characteristics and applications of semiconductor devices like p-n junction diode, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), Metal oxide Semiconductor Field Effect Transistor (MOSFET) and various special devices. Emphasis is placed on analysis, selection and proper biasing of transistors like BJT and FET.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Remember the transport phenomena of charge carriers in a semiconductor.
CO2: Understand the operation of Diode, BJT and FET.
CO3: Apply different types of filters in AC to DC conversion.
CO4: Analyze the different types of diodes, operation and its characteristics.
CO5: Evaluate the different biasing techniques used in BJT and FET.

UNIT – I
Semiconductor Physics: Energy band theory of crystals,conductors, insulators, semiconductors,mobility and conductivity,energy distribution of electrons,electrons and holes in an Intrinsic Semiconductor, Conductivity of a semiconductor, Carrier concentrations in an intrinsic Semiconductor, donor and acceptor impurities, mass action law,charge densities in a semiconductor with impurities, fermi level in a semiconductor with impurities, diffusion,carrier lifetime,continuity equation, hall effect.

UNIT – II
Semiconductor Diode Characteristic: Qualitative theory of the p-n Junction, p-n junction as a diode,band structure of an open circuited p-n Junction,current components in diode, qualitative theory of diode currents, Volt-Ampere Characteristic,temperature dependence of diode characteristics,diode resistance, diode capacitance-Transition and Diffusion capacitance.
Special Diodes: Operation and characteristics of Zener diode, Tunnel diode, Varactordiode, Photo diode, PIN diode, Avalanche photo diode, LASER, LED, Liquid Crystal Display, Solar cell.

UNIT – III
Rectifiers: Half wave rectifier, Full wave rectifier with center tap transformer and Bridge circuit - Derivation for DC, RMS currents and voltages, Ripple factor, Efficiency, Peak inverse voltage, Transformer utilization factor and Percentage of regulation, Comparison of rectifiers, Harmonic components in a rectifier circuit.
Rectifiers using filters: Inductor filter, Capacitor filter, L-Section filter, π-Section filter, Multiple L-Section and π -Section filters.
Regulators: Design of**v**oltage regulator using Zener diode, series and shunt voltage regulators.

UNIT – IV

Bipolar Junction Transistor (BJT): Introduction to three terminal devices, BJT-construction , types and different regions of operations, Transistor (BJT) as an amplifier, Transistor Current components-Emitter efficiency, Transport factor, Large signal current gain, Input and Output characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, relation between α , β and γ, base width modulation,Ebers-Moll Model.

Field Effect Transistors (FET): Comparison between FET and BJT, classification of FET; construction, operation, Drain and Transfer Characteristics of JFET and MOSFET.

Optical and Power Electronic Devices: Operation and characteristics of Photo Transistor, Silicon Controlled Rectifier, and Uni-Junction Transistor (UJT).

UNIT – V

BJT Biasing: Need for biasing,Transistor biasing and stability- operating Point, DC load line, AC load line, Stability factors S,S^1 and S^{11},types of biasing - Fixed Bias, Collector to Base bias and Self bias with and without emitter resistance, Thermal runaway and stability- Condition to avoid Thermal Runaway,bias compensation techniques- diode compensation for $V_{BE}$and $I_{CO,}$ thermistor and sensistor compensation.

FET Biasing: FET biasing methods – design offixed bias, self-bias and voltage divider bias.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, Publishers, New Delhi.
2. Ben Streetman and Sanjay Banerjee , "Solid State Electronic Devices", Prentice Hall

REFERENCES

1. Thomas L.Floyd, Electronic Devices, Pearson Education Publishers.
2. Allen Mottershed, "Electronic Devices and Circuits", PHI Publishers.
3. R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, Pearson/Prentice Hall Publishers.

B.Tech. (I Sem.) **17FE65 – ENGINEERING CHEMISTRY LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites : Knowledge of volumetric titration.

Course Educational Objectives:
To impart the ability to analyze water for its quality and to determine the important parameters like alkalinity and to distinguish types of titrations in volumetric analysis.To gain hands on experience in the preparation of polymers and to perform experiments based on theoretical fundamentals.

Course Outcomes: At the end of the course, the student will be able to :
CO1 : Assess alkalinity of water based on the procedure given.
CO2 : Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus**.**
CO3 : Acquire practical knowledge related to preparation of polymers.
CO4 : Exhibit skills in performing experiments based on theoretical fundamentals.

Introduction
1. Introduction to Chemistry laboratory – Molarity, Normality, Primary, secondary standard solutions, Volumetric titrations, Quantitative analysis, Qualitative analysis, etc.
2. Preparation of standard solutions, concept of standardisation, dilution to get solution of required normality.
3. Model experiment - Determination of HCl using standard Na_2CO_3 solution.

Water analysis
4. Determination of alkalinity of water sample.

Complexometric titrations
5. Estimation of $Mg^{+2}/Zn^{+2}/Ca^{+2}$ in given solution by using standard EDTA solution.

Preparation of polymers
6. Preparation of Urea formaldehyde resin.
7. Preparation of Phenol formaldehyde resin.

Redox titrations
8. Estimation of Mohr's salt by using potassium permanganate.
9. Estimation of Mohr's salt by using potassium dichromate.
10. Estimation of $KMnO_4$ by using oxalic acid.

Conductometric measurements
11. Estimation of amount of HClconductometricallyusing standardNaOH solution.
12. Estimation of amount of HClconductometrically using NH_4OH solution .

Potentiometric measurements
13. Estimation of amount of HClpotentiometrically using NaOH solution.
14. Estimation of amount of Fe^{+2}potentiometrically using $KMnO_4$ / $K_2Cr_2O_7$solution.

Demonstration Experiments
15. Determination of pH of the given sample solution using pH meter.
16. Determination of turbidity of the given sample water.

Colorimetric Analysis
17. Determination of Iron by a Colorimetric method using thiocynate as a reagent.

REFERENCES
Lab manual

B.Tech. (I-Sem.)	17EC60 – ELECTRICAL CIRCUITS AND NETWORKS LAB	L	T	P	Cr.
		-	-	2	1

Course Educational Objective : This course providesthe verification of circuit laws,theorems, resonance concepts, transient response and two-port network parameters of various linear electrical circuits using Multisim/Pspice.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the concepts of two-port network parameters

CO2: Design various tuned circuits using electronic communication.

CO3: Evaluate the parameters and transient behavior of electrical circuits.

List of Experiments

(Minimum 12 Experiments to be conducted)

1. Verification of Kirchhoff's laws for simple circuits
2. Verification of Voltage and Current Division for simple circuits
3. Verification of Superposition Theorem.
4. Verification of Thevenin's Theorem.
5. Verification of Norton's Theorem.
6. Verification of Reciprocity Theorem.
7. Verification of Maximum power transfer Theorem.
8. Series Resonance.
9. Parallel Resonance.
10. Estimate the transient response of various AC circuits.
11. Two port network parameters – Z, Y Parameters.
12. Two port network parameters – h, ABCD Parameters.
13. Series connection of two port networks.
14. Parallel connection of two port networks
15. Cascade connection of two port networks.

B.Tech. (I Sem.)	17ME75 - COMPUTER AIDED ENGINEERING DRAWING LAB	L	T	P	Cr.
		1	-	2	2

Pre-requisites : NIL

COURSE EDUCATIONAL OBJECTIVE:
The main objectives of this course are to familiarize various commands used in Auto-CAD and to visualize the isometric and orthographic views of any solid object.

COURSE OUTCOMES: After completion of the course students are the able to:
CO1:. Apply Auto-CAD basics to solve practical problems used in industries where the speed and accuracy can be achieved.
CO2: Apply the principle of Orthographic projections of points, lines, planes and solids.
CO3: Evaluate their ability in applying various concepts to solve practical problems related to engineering drawing.
CO4: Convert orthographic to isometric vice versa.

At least 10 Exercises are to be conducted using Auto Cad software:

BASIC AUTO CAD COMMANDS:
1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide a line, offset).
4. Hatching &line commands (hatching with different angles& different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer& fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter& text).

PROJECTION OF POINTS AND LINES:
1. Projection of points (I, II, III, & IV quadrants).
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.

ORTHOGRAPHIC PROJECTIONS:
1. Conversion of plane objects.
2. Conversion of circular objects.
3. Conversion of both combination of plane figures and circular objects.

ISOMETRIC PROJECTIONS:
1. Conversion of plane objects.
2. Conversion of circular objects.
3. Conversion of both combination of plane figures and circular objects.

REFERENCES:
1. M. Kulkarni, A.P Rastogi, and A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
2. Bethune, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
3. N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar Publishers, 2012.

B.Tech. (I-Sem.)	17EC61 – ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	Cr.
		-	-	2	1

Course Educational Objective : This course gives an overview of basic lab equipments like CRO, Function generator, calculation basic semiconductor device parameters from their characteristics and application of p-n junction diode in rectifier circuits.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the operation of regulated power supplies, function generators and CRO.

CO2: Analyze the characteristics of different electronic devices such as diode and transistor.

CO3: Design the rectifier circuits.

List of Experiments

(The following experiments are to be simulated using PSPICE/MULTISIM/LABVIEW Software and verified by Bread board)
(Minimum 12 experiments to be conducted)

1. Study of functionality basic devices and lab equipments.
2. Measurement of signal characteristics using CRO.
3. PN Junction diode Volt-Ampere characteristics.
4. Zener diode Volt-Ampere characteristics.
5. Half wave rectifier withoutfilter.
6. Half wave rectifier with capacitor and inductor filter.
7. Full wave rectifier without filter.
8. Full wave rectifier with capacitor and inductor filter.
9. Bridge rectifier circuit with and without filter.
10. Transistor Characteristics under CB Configuration.
11. Transistor Characteristics under CE Configuration.
12. Transistor Characteristics under CC Configuration.
13. Drain and Transfer Characteristics of Field Effect Transistor.
14. Uni-Junction Transistor Characteristics.

B.Tech. (II Sem.)	17FE02 - PROFESSIONAL COMMUNICATION - II	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Students should have basics in English vocabulary andGrammar & they should write error free sentences

Course Educational Objective : To Improve vocabulary, Grammar, Verbal – Non verbal Communication; to develop adaptability, assertive skills and Team spirit for skillful management in work place; and to Interpret technical data given in the form of charts, graphs & pictograms for writing technical reports.

Course Outcomes: At the end of the course, the student will be able to

CO1 : Use appropriate vocabulary to interpret data thoroughly and to write reports effectively.
CO2 : Face any situation with confidence and voice opinions/decisions assertively.
CO3 : Use English Language effectively in spoken and written forms.
CO4 : Work effectively in teams for better result.
CO5 : Communicate effectively using verbal and non-verbal dimensions aptly.

UNIT – I
Good Manners – J.C. Hill
Vocabulary: Idioms; One-word substitutes
Grammar: Subject-Verb agreement (Concord)
Reading: If – Rudyard Kipling
Writing: Information transfer: Tables, Bar graphs, Line graphs, Pie charts, Flow charts, Tree Diagrams, Pictograms; Note-making& Abstract/Summary writing

UNIT – II
Assertive Skills: Verger – Somerset Maugham; Assertive skills from the story; Assertive skills at personal level & at workplace; Expanding proverbs & their Significance
Team work skills: White washing the fence – Mark Twain; Teamwork skills from the story; Teamwork at work place & its Importance

UNIT – III
Oh Father, Dear Father – Raj Kinger
Vocabulary: Foreign Languages and their Influence on English
Grammar: Conditional Sentences; Degrees of Comparison; Question Tags
Reading: Basic Education – M.K. Gandhi
Writing: Report Writing: Nature, Significance & Types of Reports

UNIT – IV
Adaptability: Sen˜or Payroll – W E Barrett; Understanding the Organizational Communication; Adaptability skills from the story; Expanding proverbs on Adaptability skills; Importance at work place & Real life - Active & Passive Voice; Direct & Indirect Speech.

UNIT – V

Non-Verbal Communication Skills: A real good smile – Bill Naughton; 'Wh' & 'Yes' or 'No' questions; Working on articulation and gestures; Non-Verbal Communication Skills from the story; Expanding the proverbs on Non-Verbal Communication; enhancing skills through real life experiences - Common Errors.

TEXT BOOKS

1. Board of Editors, "Fluency in English – A Course book for Engineering Students", Orient Black Swan, Hyderabad, 2016
2. Dhanavel S.P, "English and Soft Skills", Orient Black Swan, Hyderabad, 2010.

REFERENCES

1. Murphy, "English Grammar with CD", Cambridge University Press, New Delhi, 2004.
2. Rizvi Ashraf M., "Effective Technical Communication", Tata McGraw Hill, New Delhi, 2008
3. BaradwajKumkum, "Professional Communication", I.K.International Publishing House Pvt.Lt., New Delhi, 2008.
4. Raman, Meenakshi and Sharma, Sangeeta, . "Technical Communication -Principles and Practice".Third Edition. New Delhi: Oxford University Press. 2015.

B.Tech. (II Sem.)	17FE06 - TRANSFORMATION TECHNIQUES AND VECTOR CALCULUS	L	T	P	Cr.
		3	2	-	4

Pre-requisites: Basics of Integral Calculus and Vector Calculus

Course Educational Objective : In this course the students are introduced to Integral transformations which includes Laplace Transforms and Z – Transforms. They will also learn Multiple Integrals in different coordinate systems and Vector Calculus.

Course Outcomes : At the end of the course, the student will be able to :
CO1: Apply the concepts of Laplace Transforms to solve ordinary differential equations.
CO2: Apply Z - Transforms to solve difference equations
CO3: Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes.
CO4: Evaluate the directional derivative, divergence and angular velocity of a vector function.
CO5: Apply Vector Integration for curves, surfaces and volumes and relationship among themselves.

UNIT – I
Laplace Transforms
Laplace transforms of standard functions –Linear Property - Shifting Theorems, Change of Scale Property – Multiplication and Division by‘t’ - Transforms of derivatives and integrals – Unit step function –Dirac’s delta function..
Inverse Laplace Transforms
Inverse Laplace transforms– Linear Property - Shifting Properties - Convolution theorem, Applications of Laplace transforms to ordinary differential equations.

UNIT – II
Z-Transforms
Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z –transform - Convolution theorem – Solution of difference equation by Z-transforms.

UNIT – III
Multiple Integrals
Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing of order of Integration and applications to areas and volumes.

UNIT – IV
Vector Differentiation
Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl – Irrotational fields-potential surfaces - Laplacian and second order operators and related properties of sums and products

UNIT – V
Vector Integration
Vector Integration - Line integral – work done –area - surface and volume integrals. Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems

TEXT BOOKS

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. Dr. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH, New Delhi, 2010.

REFERNCES

1. Michael D. Greenberg , "*Advanced Engineering Mathematics*", 2nd Edition, TMH, New Delhi, 2011.
2. Erwin Krezig, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley & Sons, New Delhi, 2011.

B.Tech. (II Sem.)	17FE12 - APPLIED PHYSICS	L	T	P	Cr.
		3	2	-	4

Pre-requisites : Basics in Light, Conductivity in different solid materials etc.,

Course Educational Objective : To make students learn the basic concepts of Optics such as Interference, Diffraction, Polarization and Lasers; the principle of quantum mechanics, free electron theory of metals, Concept of semi conductors, diodes and different types of polarizations in dielectrics and their applications.

Course Outcomes : At the end of the course, the student will be able to :

Co1:Define the nature of Interference and Diffraction.
Co2: Describe the polarization and LASER, types of lasers and their applications.
Co3: Estimate the electrical conductivity in metals.
Co4: Design the circuits of semiconductor diodes, LED, Photodiode, Solar cell.
Co5: Classify the different types of polarisations in dielectric materials.

UNIT – I : INTERFERENCE AND DIFFRACTION

INTERFERENCE: Introduction, coherence, Conditions for Interference, Interference in thin film by reflection, Newton's rings (reflection), Working principle of Interferometer.

DIFFRACTION: Introduction, Diffraction, Fraunhofer diffraction at single slit- Diffraction due to circular aperture –Diffraction due to N- slits- Diffraction Grating- Resolving power of Grating, Telescope.

UNIT – II : POLARIZATION AND LASERS

POLARIZATION: Introduction – Polarization of light, Brewster's law –Double refraction ,Quarter wave plate – Half wave plate - Polarimeter.

LASERS: Introduction- Characteristics of Lasers – Principle of laser (Absorption, Spontaneous and stimulated emission of Radiation), Einstein Coefficients - Nd-YAG laser, Helium Neon Laser.

UNIT – III : PRINCIPLESOF QUANTUM MECHANICS&FREE ELECTRON THEORY

PRINCIPLES OF QUANTUM MECHANICS

De Broglie waves, Experimental verification- Schrodinger wave equation-time independent wave equation, physical significance of the wave function – particle in a box.

FREE ELECTRON THEORY

Classical free electron theory- Postulates , Expression for electrical conductivity and drift velocity, Advantages and Draw backs, Fermi-Dirac statistics(qualitative treatment only), Classification of Solids on the basis of Band theory.

UNIT – IV: SEMI CONDUCTOR PHYSICS

Conductivity of Intrinsic and Extrinsic semiconductors, Drift and Diffusion Einstein relation, Hall Effect, Differences between direct and indirect Band Gap semiconductors, LED, photo detector, Solar Cell, Applications of Solar Cells.

UNIT – V: DIELECTRIC MATERIALS

Dielectric polarization (Electronic, ionic, orientation polarization), Local field, ClaussiusMosotti equation, Dielectric loss, Ferro electricity, Piezoelectricity, Dielectric breakdown, Applications of dielectric materials.

TEXT BOOKS

1. V. Rajendran, "*Engineering Physics*", TMH, New Delhi, 6th Edition, 2013.
2. D.K.Bhattacharya, Poonam Tandon, " Applied *Physics*", Oxford press, New Delhi, 1st Edition, 2016.

REFERENCES

1. M.N. Avadhanulu, TVS Arun Murthy, "Applied *Physics*", S. Chand & Co., 2nd Edition, 2007.
2. P.K. PalaniSamy, "*Applied Physics*", Sci. Publ. Chennai, 4th Edition, 2016.
3. P. Sreenivasa Rao, K Muralidhar, "*Applied Physics*", Him. Publi. Mumbai, 1st Edition, 2016.
4. HitendraK Mallik , AK Singh " *Engineering Physics*", TMH, New Delhi, 1stEdition,2009.

B.Tech. (II Sem.)	17EC03 - ANALOG ELECTRONIC CIRCUITS	L	T	P	Cr.
		2	2	-	3

COURSE EDUCATIONAL OBJECTIVES: This course provides the knowledge on designing of different single stage and multistage stage amplifiers, effect of capacitances on frequency response, applications of power and tuned amplifiers, importance of negative feedback in amplifiers and designing of sinusoidal oscillators.

COURSE OUTCOMES: At the end of this course student will be able to
CO1: Understand the concepts of amplifier circuits.
CO2: Analyze various types of amplifiers circuits.
CO3: Design Sinusoidal oscillators for different frequencies
CO4: Evaluate the importance of negative feedback in amplifiers.

UNIT – I
Small Signal Low Frequency Transistor Amplifiers: Hybrid parameter model of a Two Port Network, h parameter model for Transistor in CE, CB and CC Configurations, typical h parameter values, h parameter conversion from one configuration to another configuration, Analysis of CE, CB and CC Amplifiers using h parameter model, CE Amplifier with emitter resistance.
FET Amplifiers: Analysis of CG, CS and CD FET amplifiers.

UNIT – II
Multistage Amplifiers: Cascade Amplifier (RC Coupled Amplifier), Cascode Amplifier, Darlington Pair and their analysis.
Transistor at High Frequencies: The hybrid π Common Emitter Transistor model; Hybrid π conductance in terms of low frequency h parameters- Transconductance, Input Impedance, Feedback conductance, Base spreading resistance, output conductance and hybrid π capacitances; The CE short circuit current gain obtained with the hybrid-π model- Bandwidth f_β and parameter f_T, Current gain with resistive load, Transistor amplifier response with source resistance-Gain Bandwidth product.
FET at high frequency.
Frequency Response of Amplifiers: Frequency response of Single stage and double stage BJT amplifiers, Determination of High and Low cut off frequencies, Bandwidth, Effect of coupling capacitor and emitter bypass capacitor on frequency response; Frequency response of Single stage and double stage FET amplifiers, Determination of High and Low cut off frequencies, Bandwidth.

UNIT – III
Power Amplifiers: Classification of large signal Amplifiers, Distortion in Amplifiers- Second harmonic Distortion and Higher order harmonic distortion, Class A power amplifier- Direct coupled and Transformer Coupled Class B power amplifier- Push Pull and Complementary Symmetry Class AB power amplifier, Class C power amplifier, Class D and S power Amplifiers.
Tuned amplifiers: Single tuned amplifier, Double tuned amplifier and their analysis, Stagger tuned amplifier.

UNIT – IV

Feedback Amplifiers: Open loop Amplifiers- Voltage Amplifier, Current Amplifier, Transresistance Amplifier and Transconductance Amplifier, Closed loop Amplifiers- Block Diagram, Concept of negative feedback, Concept of positive feedback; Characteristics of Negative feedback Amplifiers, Classification of Negative feedback Amplifiers-Voltage Series feedback Amplifier, Voltage Shunt feedback Amplifier, Current Series feedback Amplifier, Current Shunt feedback Amplifier and their analysis.

UNIT – V

Sinusoidal Oscillators: Barkhausen Criterion, Classification of Oscillators; Hartley Oscillator, Colpitts Oscillator; RC Phase shift Oscillator using BJT and JFET; Wein Bridge Oscillator, Crystal Oscillator, Frequency and Amplitude Stability of Oscillators.

TEXT BOOK

Jacob Millman, Christos C Halkias, "Electronic Devices and Circuits", Tata McGraw Hill, Publishers, New Delhi, Fourth reprint 2011.

REFERENCES

1. Donald A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill Publishers, 2nd Edition.
2. P.John Paul, "Electronic Devices and Circuits", New Age International Publishers
3. Adel S. Sedra and Kenneth Carless Smith, "Microelectronic Circuits", Oxford University Press, 5th Edition.
4. Jacob Millman, Christos C Halkias, "Integrated Electronics", Tata McGraw Hill, Publishers, New Delhi.
5. R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, Pearson education Publishers, 10th Edition.
6. T.F. Bogart Jr., J.S.Beasley and G.Rico, Electronic Devices and Circuits, Pearson education Publishers, Reprint 1999.
7. David A. Bell, Electronic Devices and Circuits, Oxford University Press.
8. B.Visvesvara Rao etal., "Electronic Circuit Analysis", Pearson Education Publishers.

B.Tech. (II Sem.) **17EC04 - DIGITAL ELECTRONIC CIRCUITS**

L	T	P	Cr.
2	2	-	3

COURSE EDUCATIONAL OBJECTIVES:

In this course student will learn about the basic concepts of number systems and Boolean algebra, logic gates and realization of Boolean expressions using logic gates, realization of combinational and sequential circuits and concepts of Finite State Machines and ASM Charts

COURSE OUTCOMES: At the end of this course student will be able to

CO1: Understand number systems, Boolean algebra for digital electronic circuits.
CO2: Apply the concepts Boolean algebraic minimization.
CO3: Analyze various digital electronic circuits.
CO4: Design combinational and sequential logic circuits.

UNIT - I

Number Systems: Number system, complements, signed Binary numbers. Binary Arithmetic, Binary codes –BCD, Excess 3 code, Gray code, Error detecting and correcting code – Hamming code, conversion from one code to another.

Boolean Algebra: Boolean postulates –De-Morgan's Theorem, Principle of Duality, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS)- Minterm and Maxterm, Canonical forms – Conversion into canonical form–Karnaugh map Minimization (up to 5 variables)- Don't care conditions.

UNIT - II

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive –OR and Exclusive – NOR, positive logic and negative logic, Realization of Boolean Functions using logic gates (Multi level gate implementations- AND -OR, OR - AND, NAND -NAND, NOR -NOR, NAND-NOR & NOR - NAND realizations. AND, OR, NOT, NAND and NOR gates using Resistors, Diodes and Transistor.

UNIT - III

Combinational Logic Circuits: Design procedure, Adders and Subtractors – Serial adder/ Subtractor, Parallel adder/ Subtractor- Carry look ahead adder, BCD adder, Magnitude Comparator, Decoder, encoder, Multiplexer, Demultiplexer, Parity checker, code converters.
Hazards: Static ,Dynamic, Essential –Hazards elimination.
Programmable Logic Devices–Programmable Logic Array, Programmable Array Logic.Implementation of combinational logic using MUX, PROM, PAL and PLA.

UNIT - IV

Sequential Logic Circuits: Latches, Flip flops-SR, JK, T, D and Master slave – Characteristic and excitation tables, characteristic equations. Modes of triggering – Edge and Level Triggering, Realization of one flip flop using other flip flops, Registers and their operation, synchronous and Asynchronous counters.

UNIT - V

Finite state machines: Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines. Realization of Sequence detector. Conversion between Mealy and Moore machines.

Algorithmic State Machines: Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations.

TEXTBOOK

Morris Mano, "Digital Design", PHI Publishers, 4th Edition.

REFERENCES

1. ZviKohavi, Switching & Finite Automata theory, TMH Publishers, 2nd Edition
2. Charles H. Roth, "Fundamentals of Logic Design", Cengage learning Publishers.
3. M.Subramanyam, "Switching Theory and Logic Design", University Science Press Publishers.
4. John M. Yarbrough, "Digital Logic: Applications and Design", Thomson Publications.
5. Anandakumar, "Switching Theory and Logic Design", PHI Publishers.

B.Tech. (II Sem.) **17FE60 - ENGLISH COMMUNICATION SKILLS LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites: Students should have fundamental knowledge in making sentences and be with readiness to speak

Course Educational Objective:
To improve the proficiency of students in English with an emphasis on better communication in formal and informal situations; Develop speaking skills required for expressing their knowledge and abilities and to face interviews with confidence.

Course Outcomes: At the end of the course, the student will be able to
CO1 : Articulate English with good pronunciation.
CO2 : Manage skilfully through group discussions.
CO3 : Communicate with the people effectively.
CO4 : Collect and interpret data aptly.

Syllabus: English Communication Skills Lab (ELCS) shall have two parts:
- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self- study by learners.
- **Interactive Communication Skills (ICS) Lab.** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo – audio & video system and camcorder etc.

Exercise – I
CALL Lab:
Understand:Sentence structure, written language.
ICS Lab:
Practice: Introduction to English Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs - Phonetic Transcription.

Exercise – II
CALL Lab:
Understand:Usage of various words in different parts of speech.
ICS Lab:
Practice: Ice-Breaking Activity and JAM Session – Introducing Oneself.

Exercise – III
CALL Lab:
Understand:Features of Good Conversation – Strategies for Effective Communication
ICS Lab:
Practice: Situational Dialogues – Role-Play – Expressions in various situations – Making Requests and seeking permissions.

Exercise – IV
CALL Lab:
Understand:Data collection strategies – Interpretation of collected data.
ICS Lab:
Practice: Data interpretation – Information transfer from flow charts, pie charts, bar graphs, pictograms etc.

Exercise – V
CALL Lab:
Understand:Features of Good Conversation – Strategies for Effective Communication.
ICS Lab:
Practice: Introduction to Group Discussions

Lab Manual:
Board of Editors, "ELCS Lab Manual – A Workbook of CALL and ICS Lab Activities", Orient Black Swan Pvt. Ltd., Hyderabad, 2016.

SUGGESTED SOFTWARE:
1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley,USA,2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, the Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company,USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi, 2008.

L	T	P	Cr.
-	-	2	1

B.Tech. (II Sem.) **17FE62 – APPLIED PHYSICS LAB**

Pre-requisites : Awareness about the usage of Vernier callipers, Screw Gauge etc.,

Course Educational Objective :
To make students learn the theoretical concepts, Analytical techniques and graphical analysis through completing a host of experiments with the procedures and observational skills using simple and complex apparatus.

Course Outcomes: At the end of the course, the student will be able to :
CO1: Analyze the wave characteristics of light.
CO2: Estimate the wave length and width of the slit with Laser light source.
CO3:Analyze the characteristics of semiconductor diodes.
CO4: Determine the energy band gap and the dielectric constant of a material.

List of Experiments

(ANY 8 EXPERIMENTS)

GENERAL EXPERIMENTS:

1. Study the characteristics of LED.
2. Determine the energy band gap of a semi conductor Diode.
3. Determine the frequency of AC supply by using Sonometer.
4. Study the characteristics of Zener Diode.
5. Study the magnetic field along the axis of a current carrying circular coil using Stewart's & Gee's apparatus and to verify Biot - Savart's law.
6. Study the characteristics of Solar cell
7. Determine the dielectric constant of a dielectric material.
8. Study the characteristics of Photo diode

OPTICS LAB EXPERIMENTS:

9. Determine the wavelength and divergence of a laser radiation.
10. Determine the width of a single slit by forming diffraction pattern.
11. Determine the Radius of Curvature of a Plano - Convex lens by forming Newton's Rings.
12. Find the specific rotation of sugar solution by using a polarimeter.
13. Determine the Refractive index of a material of the given prism.
14. Determine the Wavelengths of various spectral lines by using diffraction grating.
15. Determination of a thickness of thin wire by using wedge shaped film.

TEXT BOOKS

Lab Manual Prepared by the LBRCE.

B.Tech. (II Sem.) **17ME60 - ENGINEERING WORKSHOP**

L	T	P	Cr.
1	-	2	2

PRE-REQUISITES: Knowledge in dimensions and units, Usage of geometricalinstruments andanalyticalability

COURSE EDUCATIONAL OBJECTIVE:

The objective of this course is to get familiarized with various trades used in Engineering Workshop and learn the safety pre-cautions to be followed in the workshops, while working with the different tools.

COURSE OUTCOMES: After completion of the course students are the able to:

CO1 : Design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.

CO2 : Fabricateandmodelvariousbasicprototypesinthetradeoffitting suchasStraightfit, V- fit.

CO3 : Producevariousbasicprototypesinthetradeof Tin smithysuchasrectangular tray, and openCylinder.

CO4 : Perform various basic House Wiring techniques.

(Conduct at least 4 Trades with 2 exercises from each Trade and demonstrate about 2 Trades)

Trade –1: CARPENTRY SHOP

1.1. Introduction to various types of wood such as Teak, Mango, Sheesham, etc. (Demonstration and their identification).

1.2. Demonstration, function and use of commonly used hand tools.

1.3. Introduction to various types of wooden joints, their relative advantages and uses.

1.4. Care maintenance of tools and safety precautions in carpentry shop.

Job I- Marking, sawing, planning and chiselling & their practice

Job II -Preparation of half lap joint

JobIII -PreparationofMortiseand Tenon Joint

Trade –2: FITTING SHOP

2.1. Introduction to fitting shop tools, common materials used in fitting shop.

2.2. Description and demonstration of simple operation of hack-sawing, various types of blades and their specifications, uses and method of fitting the blade.

2.3. Care and maintenance of tools & safety precautions in fitting shop.

Job I-Making a L-Fit from a rectangular piece of MS

Job II-Making a T-Fit from a rectangular piece of MS

Job III-Making a V-Fit from a rectangular piece of MS

Job IV-Making a Half round Fit from a rectangular piece of MS

Trade -3: TIN- SMITHY SHOP

3.1. Introduction to tin -smithy shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material and specifications.

3.2. Introduction and demonstration of various raw materials used in sheet metal shop e.g. M.S. sheet, galvanized-iron plain sheet, galvanized corrugated sheet, aluminium sheets etc.

3.3. Care and maintenance of tools & safety precautions in Tin-Smithy shop.

Job I - Preparation of a rectangular tray.

Job II- Preparation of a open scoop/ funnel.

Job III - Preparation of a Single Seam Joint and Double Seam Joint.
Job IV - Preparation of a Corner Seam Joint.

Trade –4: PLUMBING SHOP

4.1. Introduction to plumbing –use of hand tools and accessories e.g. pipe vice, Die sets, adjustable spanners, pipe wrench, pipe cutter and pipes and pipe fittings -various raw materials used in plumbing such as PVC Pipes, CI Pipes, MS pipes, Brass Pipes, Copper Pipes, Aluminium Pipes.

4.2. Demonstration of hand tools used in plumbing – preparation of pipe layout and pipe threading.

4.3. Care and maintenance of tools & safety precautions in Plumbing.
Job I – preparation of pipe layout.
Job II – Pipe threading.

Trade -5: BLACK SMITHY

5.1. Introduction to Black smithy –use of tools and equipments e.g.

5.2. Demonstration of forging operations.

5.3. Care and maintenance of tools & safety precautions in Black smithy.

Job I – preparation of S –Hook.
Job II – preparation of Chisel

Trade -6: HOUSE WIRING

6.1.Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVC Conduits.

6.2.Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthing.

Job I - Two lamps in series and parallel connection with one way switch
Job II – Florescent lamp and calling bell circuit.
Job III- One lamp connection with two 2- way switches(stair case connection).
Job IV – House wiring circuit.

REFERENCE

1. LBRCE Workshop Lab Manual
2. S.K.HajraChoudary&A.K.Choudary, "Workshop Technology-I", Media Promoters and Publishers Pvt.Ltd., Mumbai, 2012.
3. B.S.Raghuvamsi, "Workshop Technology-I", Dhanpatrai and company, New Delhi, 2014.
4. P.Khannaiah, K.L.Narayana, "Workshop Mnaual", Scitech Publications India Pvt.Ltd, 2015

B.Tech. (II Sem.) **17EC62 - ANALOG AND DIGITAL CIRCUITS LAB**

L	T	P	Cr.
-	-	2	1

List of Experiments (Minimum 12 experiments to be conducted**):**

S.No.	Name of the Experiment
1	Common Emitter (CE) Amplifier
2	Common Source (CS) FET Amplifier
3	Two stage RC coupled CE Amplifier
4	Two stage RC coupled CS FET Amplifier
5	Class-A, B & C Power Amplifiers
6	Voltage /Current series Feedback Amplifier
7	RC phase shift Oscillator using Transistor
8	Realization of Logic Gates using discrete components
9	Realization of Logic Gates using Universal Logic Gates
10	Realization of Adder and Subtractor Using Universal Logic Gates
11	Realization of Flip-Flops using Universal Logic Gates
12	Realization of Counters
13	Realization of Shift Registers
14	Realization of Finite State Machine (FSM)

List of Experiments (Beyond the Syllabus):

S.No.	Name of the Experiment
1	Differential amplifier
2	Implementation of Mini project based on above experiments

B.Tech. (III Sem.)	17FE07 - NUMERICAL METHODS AND FOURIER ANALYSIS	L	T	P	Cr.
		3	2		4

Pre-requisites : None

Course Educational Objective : The main objective of this course is to enable the students learn Numerical Techniques for solving the equations, interpolation, differential equations and fitting of various cuves. They will also learn about the Fourier analysis of single valued functions.

Course Outcomes : At the end of the course, the student will be able to :

CO1: Compare the rate of accuracy between various methods in approximating the root of the equation and Distinguish among the criteria ofselection and procedures of various Numerical Integration Rules.

CO2: Estimate the best fit polynomial for the given tabulataed data using the methods of Newton's Interpolation formulae and Lagrange's Interpolation.

CO3: Apply various Numerical methods in solving the initial value problem involving the ordinary differential equation.

CO4: Estimate the unknown dependent variables using curve fitting methods..

CO5: Generate the single valued functions in the form of Fourier series and obtain the Fourier Transforms

UNIT – I

Solution of Algebraic and Transcendental Equations and Numerical Integration

Solutions of Algebraic and Transcendental Equations – RegulaFalsi method and Newton Raphson Method in one variable.

Numerical Integration

Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT – II

Interpolation and Finite Differences

Interpolation: Introduction – Finite differences- Forward Differences- Backward Differences-Central differences – Symbolic relations and separation of symbols-Differences of a polynomial-Newton's formulae for interpolation – Lagrange's Interpolation formula.

UNIT – III

Numerical solution of Ordinary Differential Equations

Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive approximations - Euler's Method - Runge- Kutta Methods.

UNIT – IV

CURVE FITTING

Curve fitting by the principle of Least Squares: Fitting of a straight line – Second degree parabola-other polynomial curves-Fitting of exponential curves –Fitting of a power curve

UNIT – V

Fourier Series and Fourier Transforms

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

Fourier Transforms

Fourier integral theorem (only statement) – Fourier transform – sine and cosine transforms – properties.

TEXT BOOKS

1. S. S. Sastry, "*Introductory Methods of Numerical Analysis*", 5th Edition, PHI, New Delhi, 2005.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH, New Delhi, 2010.

REFERENCES

1. B.S. Grewal , "*Higher Engineering Mathematics*", 42ndEdition, Khanna Publishers, New Delhi, 2012.
2. Steven. C. Chopra, Ra. P. Canale, "*Numerical Methods for Engineers with programming and software application*",4th Edition, TMH, New Delhi, 2002.
3. M. K. Jain, S. R. K. Iyengar, R.K. Jain, "*Numerical Methods for Scientific and Engineering Computation*", 5th Edition, New Age International Publishers, New Delhi, 2007.

B.Tech. (III Sem.)	17CI01 - COMPUTER PROGRAMMING	L	T	P	Cr.
		2	2	-	3

Pre-requisites : NIL

Course Educational Objective: In this course student will learn about
The basic elements of C programming structures like data types, expressions, control statements, various I/O functions and how to solve simple mathematical problems using control structures.The derived data types like arrays, strings, various operations on them. Modular programming using functions and Memory management using pointers.User defined structures and various operations on it.The basics of files and its I/O operations.

Course Outcomes: At the end of the course, the student shall be able to:
CO1: Identify basic elements of C programming structures like data types, expressions,control statements, various simple functions and inview of using them in problem solving.
CO2: Apply various operations on derived data types like arrays and strings in problem solving.
CO3: Design and Implement Modular Programming and memory management using pointers.
CO4: Implement user defined data structures used in specific applications.
CO5: Compare different file I/O operations on text andbinary files.

UNIT – I
Introduction to Problem solving through C-Programming: Problem Specification.
Algorithm / pseudo code, flowchart, examples.
C-Programming: Structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample C program, operators: arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation.
Conditional statements: if, if else, else if ladder and switch statements, continue, goto. Loops: while, do-while and for statements, break, programming examples.

UNIT – II
Arrays- one dimensional arrays-concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays.
Character Strings: declaration, initialization, reading, writing strings, arithmetic operations on characters, string handling functions, programming examples

UNIT – III
Functions: basics, category of functions, parameter passing techniques, recursive functions-comparison with Iteration, Functions with arrays, storage classes- extern, auto, and register, static, scope rules, Standard library functions, dynamic memory management functions, command line arguments, programing examples.
Pointers- concepts, declaring &initialization of pointer variables, pointer expressions, pointer arithmetic, pointers and arrays, pointers and character strings, pointer to pointer, Pre-processor Directives and macros.

UNIT –IV

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, array of structures, structures and functions, pointer to structure, self-referential structures, unions, typedef, programming examples.

UNIT – V

Files – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling, and programming examples.

TEXT BOOKS

Jeri R.Hanly, Elliot B.Koffman, Problem Solving and Program Design in C, Pearson Publishers, 7th Edition, 2013

REFERENCE

1. N.B.Venkateswarlu and E.V.Prasad, C and Data Structures, S.Chand Publishing, 1st Edition, 2010,
2. ReemaThareja, Programming in C, Oxford University Press, 2nd Edition, 2015
3. Stephen G.Kochan, Programming in C, Pearson Education, 3rd Edition, 2005
4. PradeepDey, Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011
5. E Balagurusamy, Computer Programming, McGraw Hill Education, 1st Edition

B.Tech. (III Sem.)	17EC05 - SIGNALS AND SYSTEMS	L	T	P	Cr.
		2	2		3

Pre-requisites: Vectors, Scalars, Approximation of a vector by another vector, Differentiation and Integration of signals

Course Educational Objectives: This course describe signals mathematically and how to perform mathematical operations on signals, represents the signals in both time and frequency domains, provides the concepts of sampling, the response of a linear system,the signal approximation using orthogonal functions and Fourier series, the Fourier Transform and its properties, Laplace Transforms and their properties, analysis of systems using Laplace Transforms.

Course Outcomes (COs): At the end of this course, student will be able to

CO1 Rememberthe classifications and properties of signals& systems, properties of Fourier & Laplace Transforms.

CO2 Understand the fundamental characteristics of signals, systems and their classifications.

CO3 Applymathematical tools to model and examine signals and systems in both time and frequency domains.

CO4 Analyzetheconcept of Fourier Series, Sampling Theorem, Region of convergence and convolution in time and frequency domain.

CO5 Evaluatethe systems for linearity, causality, time variance, stability, memorability and realizability.

UNIT – I

Signal Analysis: Concept of Signal, Classification of Signals:-Continuous Time and Discrete Time, Analog and Digital, Causal, Anti-Causal andNon-Causal, Periodic and Aperiodic, Energy and Power, Deterministic and Random, Even and Odd, Real Exponential and Complex Exponential; Representation of Signals: Impulse, Unit Step, Unit Ramp, Signum, Decaying Exponential, Raising Exponential, Double Exponential, Rectangular, Sinc and Sampling Signals; Operations on Signals: Time Shifting, Time Scaling, Time Reversal (Folding), Amplitude Scaling, Convolution- Graphical Method of Convolution.

UNIT – II

Signal Approximation: Approximation of a Signal by another signal-Mean square error, Condition for orthogonal signals; Approximation of a Signal by a set of mutually orthogonal signals-Evaluation of Mean square error, Gibbs Phenomena, Orthogonality in complex signals; Approximation of a complex signal by another complex signal-Approximation of a complex signal by a set of mutually orthogonal complex signals.

Fourier series: Concept of Fourier series, Trigonometric Fourier series, Exponential Fourier series, Relations among coefficients of Trigonometric Fourier series and Exponential Fourier series, Representation of Periodic signal by Fourier series over the entire interval, Existence of Fourier Series, Symmetry conditions of Fourier series, Parsevalls Theorem, Complex Fourier Spectrum-Line and Power Spectrum.

UNIT – III

Fourier Transforms: Need of Transform, Deriving Fourier Transform from Fourier Series, Existence of Fourier Transform, Properties of Fourier Transform:- Symmetry, Linearity, Scaling, Time Reversal, Time Shifting, Frequency Shifting, Time Differentiation, Time Integration, Frequency Differentiation, Frequency Integration, Time Convolution, Frequency Convolution and Parseval's Theorem; Fourier Transform of Aperiodic Signals, Fourier Transform of Periodic Signals.

Sampling Theorem:Representation of continuous time signal by its samples, Graphical and analytical proof of sampling theorem for Band Limited Signals, impulse sampling, Reconstruction of signal from its samples, effect of under sampling- Aliasing.

UNIT – IV

Signal Transmission Through Linear Systems: Definition of System, Classification of Systems- Linear and Non Linear, Time Invariant and Time Variant, Causal and Non Causal, Stable and Unstable, Static and Dynamic, Invertible and Non-invertible; System Bandwidth, Response of Linear Systems:-Transfer Function, Impulse Response, Response of Linear Systems with an arbitrary input, Distortion less Transmission through a system, Filter Characteristics of Linear System, Ideal Filter characteristics of LPF, HPF, BPF and BEF, Physically Realizable system and Poly-Wiener criterion.

Correlation Functions and Spectral Densities: Autocorrelation Function and Properties, Energy Spectral Density, Power Spectral Density, Cross Correlation Function and Properties.

UNIT – V

Laplace Transforms: Concept of Laplace Transform on Non-Causal, Causal and Anti-Causal Signals, Relation between Laplace Transform and Fourier Transform, Existence of Laplace Transform; Properties of Laplace Transform- Linearity, Time Scaling, Time shifting, Shifting in S domain, Conjugate, Differentiation in time domain, Integration in time domain, Differentiation in S-domain, Integration in S-domain, Convolution in time domain, Convolution in S-domain, Initial value and Final value theorems. Laplace Transform of various classes of Signals, Concept of Region of Convergence and Properties, Inverse Laplace Transform using Partial Fractions method. Applications of Laplace Transforms- Causality of a system, Stability of a system, Solving of differential equations and Analysis of RLC circuits.

TEXT BOOK

1. A V Oppenheim, A S Wilsky and IT Young, Signals and Systems, PHI/Pearson publishers, 2nd Edition.
2. B P Lathi, Signals, Systems and Communications, BSP, 2003, 3rd Edition.

REFERENCE

1. Simon Haykin, Signals and Systems, John Wiley, 2004
2. HWEI P.HSU, Signals and Systems, Schaum's Outlines, Tata McGraw Hill, 2004.
3. Michel J. Robert, Fundamentals of Signals and Systems, McGraw Hill Publishers.
4. NarayanaIyer, Signals and Systems, Cengage Learning Publishers, 2011.
5. P. Ramesh Babu, Signals and Systems, Scitech Publications Pvt Ltd, Chennai, 2013
6. A.Anand Kumar, Signals and Systems, 2nd Edition, PHI, 2012.
7. K.RajaRajeshwari and B.Visveswararao, Signals and Systems, PHI, 2014

B.Tech. (III Sem.)	17EC06 - RANDOM VARIABLES AND STOCHASTIC PROCESSES	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Probability Theory

Course Educational Objective: This course provides the knowledge on random variables and their statistical behavior. It also provides the complete information about temporal and spectral characteristics of random processes. The course also provides the information about evaluation of system response to random inputs. Further it introduces the noise as a random process.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Analyze the Statistical Properties of random variables through understanding of distribution and density functions
CO2	Evaluate the statistical parameters of Random Processes in temporal domain.
CO3	Estimate various spectral characteristics of random processes
CO4	Apply the concept of Random Processes for analysis of linear systems

UNIT-I

The Random Variable: Concept of random variable, Condition for a function to be a random variable, Classification of a random variable, Cumulative distribution function and properties, Probability density function and properties, Different distributions-Binomial, Poisson, Uniform, Exponential, Rayleigh, Gaussian.

Operations on One Random Variable: Expectation, Moments about the origin, Central moments, Variance, Skew, Skewness, Characteristic function and properties, Moment generating function and properties, Transformations of a random variable.

UNIT-II

Multiple Random Variables: Vector random variables, Joint distribution function and properties, Marginal distribution functions, Joint density function and properties, Marginal density functions, Joint Conditional distribution and density functions, statistical independence, Distribution and density of sum of random variables, Central limit theorem (proof not expected).

Operations on Multiple Random Variables: Expected value of a function of random variables, Joint moments about the origin, Correlation, Joint central moments, Covariance, Correlation coefficient, Joint characteristic function and properties, Jointly Gaussian random variables- two and N random variables, properties.

UNIT-III

Stochastic Processes-Temporal Characteristics: Concept of stochastic processes, Classification of stochastic processes, Deterministic and Nondeterministic processes. Distribution and density of stochastic processes, Statistical independence processes, First-Order stationary processes, Second-Order and Wide-Sense Stationary processes, N-Order and Strict-Sense stationary processes. Time Averages and Ergodicity, Mean-Ergodic processes, Correlation Ergodic Processes.

Correlation Functions: Autocorrelation function and properties, Cross-Correlation function and properties, Auto covariance function, Cross covariance function.

UNIT-IV

Stochastic Processes-Spectral Characteristics: Power spectral density of processes and properties, Bandwidth of power spectral density, Wiener-Khintchine relation, Cross power spectral density and properties, Relation between cross power spectral density and cross-correlation function.

UNIT-V

Linear Systems with Random Inputs: Concept of linear system, System response, Mean value of system response, Mean squared value of system response, Autocorrelation function of response, Cross correlation function of input and output, Power spectral density of response, Cross power spectral density of input and output.

Noise: Definition, classification, white noise, band limited white noise, band pass white noise, and colored noise.

TEXT BOOK

1. Peyton Z. Peebles, Jr, "Probability, Random Variables and Random Signal Principles", Tata Mc Graw-Hill, 4th edition, New Delhi.

REFERENCES

1. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochstic Processes", Tata Mc Graw-Hill, 2002 edition, New Delhi.

2. Hwei Hsu, "Probability, Random Variables and Random Processes", Schaum's Outline series, Tata McGraw-Hill Publishers, New Delhi.

3. H.Stark and J.W. Woods, "Probability and Random Processes with Applications to Signal Processing", Pearson Education Publishers.

4. Wim C. Van Etten, "Introduction to Random Signals and Noise", John Wiley and Sons Inc.

5. Taub and Schilling, "Principles of Communication Systems", Second Edition, Tata McGraw-Hill, Publishers, New Delhi.

6. Y Mallikarjuna Reddy, "Probabilty theory and Staochastic Processes", Universites Press (India), Pvt Ltd.

B.Tech. (III Sem.)	17EC07 - PULSE AND SWITCHING CIRCUITS	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Electronic Devices and Circuits

Course Educational Objective: This course provides the knowledge on linear and nonlinear wave shaping circuits, switching characteristics of diode and transistor. This course also gives an idea about operation, analysis and design of different types of multi-vibrator circuits, time base generators and sampling gates.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Analyze the output characteristics of linear circuits for different test signals.

CO2: Developnonlinear circuits like clippers and clampers using active and passive elements.

CO3: Examinethe switching characteristics of nonlinear elements used in various digital circuits.

CO4: Designvarious multivibrator circuits.

CO5: Illustratethe operation of various time base generator circuits and sampling gates.

UNIT-I

Linear Wave Shaping Circuits: Low pass and High pass RC circuits and their response for sinusoidal, step, pulse, square and ramp inputs. RC circuit as differentiator, integrator and double differentiator.

UNIT-II

Non Linear Wave Shaping Circuits: Clipper circuits using PN Junction, Zener Diodes and Transistor, clipping at two independent levels, Emitter coupled clipper, Comparators, applications of voltage comparators, Clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem and practical clamping circuits.

UNIT-III

Switching Characteristics of Devices: Diode Modeling, Transistor as a switch, Diode and transistor Switching Times, Saturation parameters of Transistor and their variation with temperature.

Multivibrators-I: BistableMultivibrator-Fixed bias, self-biased transistor binary, Principle of operation, analysis and design of BistableMultivibrator.

UNIT-IV

Multivibrators-II: Triggering types,Schmitt trigger circuit-Principle of operation, analysis and design, calculation of UTP, LTP and applications, Collector-coupled Monostable and AstableMultivibrators Principle of operation, analysis and design.

UNIT-V

Time Base Generators: Features of Time Base Signals, Types of errors and relation between them, Methods of generating time based signals, UJT saw tooth generator, Bootstrap and Miller integrator ramp generators.

Sampling Gates: Operating principles of sampling gates, Unidirectional and Bi-directional sampling gates: two diode, four diode, and two transistor sampling gates, Reduction of pedestal in sampling gate circuits, applications of sampling gates.

TEXT BOOKS:

J.Millman and H.Taub, "Pulse, Digital and Switching Waveforms", McGraw-Hill Publishers, 2nd Edition.

REFERENCES:

1. A. Anand Kumar, **"**Pulse and Digital Circuits", PHI Publishers, 2005.
2. K. Venkatarao, K. Rama Sudha and G. Manmadharao, "Pulse and digital circuits", Pearson education Publishers.
3. V. U. Bakshi and A. P. Godse, **"**Pulse and Digital Circuits", Technical Publications, Pune.
4. J. B. Gupta, **"**Pulse and Digital Switching Circuits", SK. Kataria and Sons Publications, New Delhi.

L	T	P	Cr.
2	2	-	3

B.Tech. (III Sem.) **17EC08 - ANALOG INTEGRATED CIRCUITS**

Pre-requisites: Analog Electronic circuits.

Course Educational Objective: This course provides the knowledge on basic Integrated Circuit (IC), Op-amp internal structure and various open-loop and closed loop applications of it. Design of Active Filters and different waveform generators. It provides the importance of 555 timer and its applications. It also explains the Phased Locked Loop, its applications and ADC and DAC converters.

Course Outcomes (COs): At the end of the course, students will be able to

CO1 Rememberthe fundamental concepts of Differential amplifiers and Transistor current sources.

CO2 Understand the concepts and applications of Op-Amp.

CO3 Designdifferent types of Active filters and waveform generators.

CO4 Apply the 555 Timer circuits and Phased Locked Loop for various applications.

CO5 Evaluate the performance of ADC and DAC.

UNIT-I:

Introduction: Integrated Circuit Definition, Meaning of MSI, LSI, VLSI, ULSI, Types of Integrated circuits and their features, Differences between Analog IC and Digital IC.

Transistor Current Sources: Basic Current Source, Modified Basic Current Source, Widlar Current Source, Cascode Current Source, Wilson Current Source, their analysis.

Differential Amplifiers: Classifications of differential amplifiers, DC and AC analysis of all differential amplifier Configurations, specifications of differential amplifiers, FET differential amplifier, DC Coupling and Cascade Differential Amplifiers, Level translator.

UNIT-II:

Operational Amplifiers: Op-amp Block Diagram, Package Types and temperature ranges, IC 741 op-amp and its features, Power supply requirement to operate Op-amp IC741, Ideal and practical characteristics of Op-amp, DC and AC characteristics of Op-Amp, IC 741 Op-Amp specifications, Measurement of slew rate and CMRR.

Applications of OP Amps: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, AC amplifier, AC Voltage follower, Analog multiplier, Four Quadrant multiplier, squarer circuit, Analog divider, Square root circuit, V to I, I to V converters, Rectifiers, Sample and Hold circuit, Log and Anti log amplifiers.

UNIT-III:

Op Amp Active Filters: Low pass filters, High pass (1st order, 2nd order) filters, Band pass filters, Band reject filters and all pass filters using OP AMP.

Op Amp Waveform Generators: Triangular wave Generator, Square wave Generator, Comparator circuit, Regenerative comparator (schmitt trigger), Multivibrators (Astable and Monostable).

Op Amp Sine wave Oscillators: RC Phase shift Oscillator, Wien Bridge Oscillator using OP AMP.

UNIT-IV:

555 Timers: Functional Diagram, Pin Diagram, Monostable and Astable Operations and Applications, Schmitt Trigger.

Phase Locked Loops: VCO - IC 566 its features, IC 565 PLL Block Schematic, Principles and Description of individual Blocks, Applications of PLL.

IC Voltage Regulators: Fixed Voltage Regulators, IC723 General Purpose Regulator (Basic Low & High Voltage).

UNIT-V:

Digital to Analog Converters: Weighted resistor DAC, R-2R Ladder DAC, Inverted R-2R DAC

Analog to Digital Converters: Flash (Comparator) Type ADC, Counter Type ADC, Tracking Converter, Successive Approximation ADC, Charge Balancing ADC, Dual Slope ADC; Specifications of DAC and ADC.

TEXT BOOKS

1. Ramakanth A. Gayakwad, Op-amps and Linear Integrated Circuits, PHI Publishers, 4th Edition.

REFERENCES

1. D. Roy choudhury, Linear Integrated Circuits, New Age International (P) Ltd.
2. M.H Rashid, "Microelectronic Circuits: Analysis and Design", PWS Publishing Company, 2nd Edition.
3. R.F. Coughlin and Fredrick Driscoll, Operational Amplifiers and Linear Integrated Circuits, PHI Publishers.
4. K. Lal Kishore, Operational Amplifiers and Linear Integrated Circuits, Pearson education Publishers.

B.Tech. (III Sem.) **17CI60 - COMPUTER PROGRAMMING LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites: NIL

Course Educational Objective: In this course student will learn about
Software development tools like algorithm, Pseudo codes and programming structure. Basic elements C programming structures like data types, expressions, Control statements, various I/O functions and how to solve simple mathematical Problems using control structures.Designand implementation ofvarious software components which solve real world problems.

Course Outcomes: At the end of the course the student will be able to
CO1: Apply and practice logical formulations to solve some simple problems leading to specific applications.
CO2: Demonstrate C programming development environment, compiling, debugging, linking and executing a program using the development environment.
CO3: Design effectively the required programming components that efficiently solve computing problems in real world.
Mandatory: All Programs must have Algorithms and Flow Charts

LAB CYCLESSYLLABUS

I) Exercise Programs on Basics of C-Program
Write a program in 'C' language to cover the following problems.
a) Example program which shows the usage of various preliminaryData types available in C Language.
b) Example program which shows the usage of various Operators available in C Language.
c) Example programs to illustrate the *order of evaluation.*

II) Exercise Programs on Control Structures:
a) To check whether the given year is leap year (or) not
b) Roots of Quadratic Equation.
c) Finding smallest& biggest number from the given set of 4 numbers using 'if' statement.
d) Calculate the student grade in the examination – assume suitable Constraints.
e) Prepare electricity bill for the consumed units – assume suitable Constraints.
f) Converting given two digit number into words using switch statement
g) To illustrate the usage of 'goto' statement.

III) Exercise Programs on Loops:
a) To Display first N natural numbers
b) To find whether the given number is Armstrong (or) not
c) To find reverse of the given number and to check whether it is palindrome (or) not.
d) To find whether given number is strong number (or) not.
e) To check whether given number is Prime (or) not
f) To display prime numbers with in the given range (Nesting of Loops).
g) To display the following structure (Nesting of Loops)

i)

```
        1
      1   2
    1   2   3
  1   2   3   4
1   2   3   4   5
```

ii)

```
5 4 3 2 1
  4 3 2 1
    3 2 1
      2 1
        1
```

IV) Exercise Programs on Arrays& Strings:

Write example programs in C Language to perform following operations:

a) Finding the sum and average of given numbers using Arrays.
b) To display elements of array in reverse order
c) To search whether the given element is in the array (or) not using linear search &binary search.
d) Write a C program to perform the following operations
   i) Addition, subtraction and multiplication of Matrices
   ii) Transpose of given matrix
   (The above operations are to be exercised using functions also bypassing arguments)
e) Write a C program to find whether the given string is palindrome (or) not.
f) To accept line of text and find the number of characters, number of vowels andnumber of blank spaces in it.
g) Write an example program to illustrate the use of any 5 stringhandling functions.

V) Exercise Programs on Functions &Pointers:

a) Example program to bring clarity on pointer declaration &initialization and Pointer arithmetic.
b) Write an example program to describe the usage of *call by reference*.
c) Write a program to find sum of the elements of the array using functions.

VI) Exercise Programs on Functions:

Write example programs in C Language:

a) To find factorial of a given number using functions.
b) Swap two numbers using functions.
c) To find GCD of two numbers using recursion
d) Write a recursive function to solve Towers of Hanoi problem.
e) Write an example program to illustrate use of external &static storage classes.
f) Write an example program to illustrate the usage of command line arguments.
g) Program to illustrate the usage of dynamic memory management functions.

VII) Exercise Programs on Derived data types:

a) Write an example program using structures to process the student record. Assume suitable fields for student structures (Different kinds of initialization of structure variables are to be exercised)
b) Write a program to read records of 10 employees and find their average salary (Exercise array of structures & Nested structures concepts through this program).
c) Write a program to handle a structure variable using pointers and implement self referential structure(i.e. A structure variable having a pointer to itself)

VIII) Exercise Programs on Files:

Write an example program on file to perform following operations:

a) Accessing content from files and writing content in to it.
   (Exercise different file operation modes)
b) Copy the contents of one file into another.
   (Exercise different file operation modes)

B.Tech. (III Sem.)	17EC63 - PULSE AND SWITCHING CIRCUITS LAB	L	T	P	Cr.
		-	-	2	1

Pre-Requisites: Electronic Devices and Circuits

Course Educational Objective: This course provides practical exposure on linear, non linear wave shaping circuits and switching behavior of non linear devices. It also demonstrates the generation of non sinusoidal signals, as well as realization of sampling circuits.

Course Outcomes: At the end of the course, student will be able to:

CO1: Analyze the response of linear and non linear wave shaping circuits.
CO2: Examinethe switching behavior of a transistor**.**
CO3: Synthesizenumerous non-sinusoidal waveform generators**.**

LIST OF EXPERIMENTS (Minimum 12 Experiments to be Conducted)

1. Linear Wave Shaping Circuits-Low Pass
2. Linear Wave Shaping Circuits- High Pass
3. Non Linear Wave shaping Circuits - Clippers
4. Non Linear Wave shaping Circuits – Clampers
5. Clamping Circuit Theorem
6. Switching behavior of Transistor
7. BistableMultivibrator
8. MonostableMultivibrator
9. AstableMultivibrator
10. Schmitt Trigger
11. Bootstrap Time Base Generator
12. Miller Time Base Generator
13. UJT Relaxation Oscillator
14. Sampling gates

B.Tech. (III Sem.) **17EC64 - ANALOG INTEGRATED CIRCUITS LAB**

L	T	P	Cr.
-	-	2	1

Course Educational Objective: This course provides the practical knowledge on Op-Amp applications like arithmetic circuits, filters and oscillators also provides knowledge on IC555 timer and IC723.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Build the basic applications of op-amp, VCO and PLL.

CO2: Design filters, Oscillators and DAC using IC 741 Op-Amp.

CO3: Implement Multivibrators and Voltage Regulators using ICs.

List of Experiments

(Minimum Twelve experiments are to be conducted)

1. Arithmetic circuits using Op-Amp
2. Integrator and differentiator using Op-Amp
3. Function Generator Using Op-Amp
4. Low Pass and High Pass Filters using Op-Amp
5. Band Pass Filter using Op-Amp
6. Band Stop Filter using Op-Amp
7. RC Phase shift Oscillator using Op-Amp
8. Wien Bridge Oscillator using Op-Amp
9. Monostable and Astable Multivibrators using IC 555
10. Voltage Controlled Oscillator
11. Phase Locked Loop
12. Voltage Regulator Using IC 723
13. Digital to Analog Converter using Op-Amp

B.Tech. (III Sem.)	17PD03 - PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	Cr.
		3	-	-	0

Pre requisite: Basic Sciences and Humanities

COURSE EDUCATIONAL OBJECTIVES:

1. To create an awareness on engineering ethics and human values.
2. To adumbrate the inevitability of different intellectual property rights like patents, copyrights, trademarks, and trade secret.
3. To give an impetus on achieving higher positions in profession, with ethical and human values as a base and support for the growth.
4. To explicate the professional and societal responsibilities of the engineers.
5. To make the student realize the sensitiveness associated with experimentation process

COURSE OUTCOMES: At the end of the course, the student

CO1 : Acquires the basic concepts of human values & also gain the connotations of ethical theories.

CO2: Knows the basic concepts of Professional ethics and handling Dilemma in decision making.

CO3: Knows the duties and rights towards the society in an engineering profession

CO4: Would realize the importance and necessity of intellectual property rights.

CO5: Can take all the necessary precautions while conducting the experiments, which may reduce the risk.

UNIT –I: **ETHICS**

Senses of 'Engineering Ethics' -Variety of moral issues - Types of inquiry -Moral dilemmas Moral autonomy -Kohlberg's theory Gilligan's theory -Consensus and controversy – Models of Professional Roles -Theories about right action- Self interest - Customs and religion -Uses of Ethical theories.

UNIT - II: HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning - Civic Virtue –Respect for Others–Living Peacefully – Caring – Sharing - Honesty – Courage– Valuing Time - Cooperation – Commitment – Empathy – Self Confidence – Character – Spirituality

UNIT – III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation- Engineering Projects VS. Standard Experiments - Engineers as responsible experimenters – Codes of ethics - Industrial Standards - Abalanced outlook on law- The challenger case study.

UNIT – IV: SAFETYAND RESPONSIBILITIES

Safety and risk- Assessment of safety and risk- Risk benefit analysis and reducing risk- Three Mile Island and Chernobyl case study - Collegiality and loyalty -Respect for authority- Collective bargaining – Confidentiality- Conflicts of interest- Occupational crime-Professional Rights-Employee Rights –Intellectual Property Rights(IPR) discrimination.

UNIT – V: GLOBAL ISSUES

Multinational Corporation’s -Environmental ethics-computer ethics -weapons development Engineers as managers - consulting engineers-engineers as expert witnesses and advisors, Moral leadership - sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. R.S.Nagarajan, a Textbook on "Professional Ethics and Human Values", New Age Publishers – 2016.
2. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.
3. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M. Jayakumaran- Laxmi Publications.
4. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.

REFERENCES

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
3. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available).
4. John R Boatright, "Ethics and the conduct of business", Pearson Education, New Delhi,2003.
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of ethics for scientists and engineers", Oxford University Press, Oxford, 2001.
6. "Fundamentals of ethics for scientists and engineers" Edmund G Cseebauer and Robert L Barey,Oxford University Press, 2001.
7. "Text book on Intellectual Property rights", N K Acahrya, Asian Law House, 7th edition,2014.
8. "An Introduction to Intellectual Property Rights", Dr.J.P.Mishra,Central law House, 3rd edition,2012.

B.Tech. (IV Sem.)	17FE03 - ENVIRONMENTAL SCIENCE	L	T	P	Cr.
		3	-	-	3

Pre-requisites : None

Course Educational Objective :

To provide a general background on developing an understanding of systems and cycles on the earth and how individual organisms live together in complex communities.

To enable the students in understanding how human activities influence our air, water and soil and it also helps in developing a right attitude about our use of fossil fuels and effect on climate and sustainable management of natural resources.

Course Outcomes: At the end of the course, the student will be able to :

CO1: Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions.

CO2: Evaluate local, regional and global environmental issues related to resources and their sustainable management.

CO3: Identify the importance of ecosystem and biodiversity for maintaining ecological balance.

CO4: Acknowledge and prevent the problems related to pollution of air, water and soil.

CO5: Interpret the significance of implementing environmental laws and abatement devices for environmental management.

UNIT – I

Nature and scope of Environmental Problems

- Introduction, components of Environment
- Scope and importance of environmental studies
- Population explosion, variations among nations
- Resettlement and Rehabilitation - Issues and possible solutions
- Environment and human health
- HIV-AIDS
- Environmental ethics
- Role of Information Technology in environmental management and human health

UNIT – II

Natural Resources and Conservation

- Introduction and classification of Natural Resources
- Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, interlinking of rivers, dams-benefits and problems. Rain water harvesting, watershed management
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, soil salinity
- Energy resources: Growing energy needs renewable, non-renewable and alternate energy resources

UNIT – III

Ecology and Biodiversity

- Definition, structure and functions of an ecosystem
- Food chains and Food webs, Ecological succession, Ecological pyramids

- Biogeochemical cycles, Major Types of Ecosystems – Forest, Grassland, Desert Land & aquatic Ecosystem, Ecological Niche and Keystone Species
- Definition and levels of measuring biodiversity - genetic, species, community and ecosystem diversity
- Bio geographical classification of India
- India as a mega diversity nation
- Values of biodiversity- Direct and Indirect values
- Threats to biodiversity; Man and wild life conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation methods

UNIT – IV

Environmental Pollution

- Introduction to Environmental Pollution Causes, effects and control measures of:
- Air pollution
- Water pollution
- Soil pollution
- Noise pollution
- Nuclear hazards
- Solid Waste Management – Sources, Classification, effects and control measures of Municipal solid waste, Biomedical waste & Hazardous and e-waste
- Environmental Issues relating to Climate change, global warming, acid rain, ozone layer depletion
- Disaster Management- Floods, Cyclones, Earthquakes, Landslides and Tsunamis.

UNIT – V

Environmental Management

- Sustainable development and unsustainability
- Stockholm and Rio Summit
- Environmental Impact Assessment (EIA)
- Green building
- Consumerism and Waste products
- Carbon credits and carbon trading
- Environmental Law- Air, Water, Wild life, Forest, and Environmental protection act

TEXT BOOKS

1. Anubha Kaushik, C.P.Kaushik, "Perspectives in Environmental Studies", New age international publishers, Delhi, 5nd edition,2016.
2. MahuaBasu, S.Xavier, "Fundamentals of Environmental Studies", Cambridge University Press, Delhi, 1st edition, 2016.

REFERENCES

1. S.Deswal, A. Deswal, "A Basic course in Environmental Studies", Educational & Technical Publishers, Delhi, 2nd Edition, 2014.
2. R. Rajagopalan, "Environmental Studies (From Crisis to Cure)", Oxford University Press, New Delhi, 3rd Edition, 2012.
3. De, A.K, "Environmental Chemistry", New Age International (P) Limited, New Delhi,5th Edition, 2003.
4. Dr.K.V.S.G. Murali Krishna, "Environmental Studies", VGS Techno Series, Vijayawada, 1st Edition,2010.
5. G. Tyler Miller, Scott Spoolman, "Introduction to Environmental Studies", Cengage Learning, New Delhi,13th Edition, 2009.

B.Tech. (IV Sem.) **17FE09 - FUNCTIONS OF COMPLEX VARIABLES**

L	T	P	Cr.
3	2	-	4

Pre-requisites: Basics of Complex numbers and Partial Differentiation

Course Educational Objective : The main objective of the course is to make student learn the concepts of the complex variables, complex functions, analyticity and how to construct the analytic function. They also learn to expand complex functions in Taylor's and Laurent series, integrate a complex function using Residue theorem.

Course Outcomes : At the end of the course, the student will be able to :

CO1: Construct an analytic function by Milne Thomson's method when the real or imaginary part is given.
CO2: Separate complex elementary functions into real and imaginary parts.
CO3: Apply Cauchy's Integral theorem to integrals.
CO4: Convert the analytic functions into Power series by Taylor series and Laurent series.
CO5: Apply Residue theorem for Real Definite Integrals and understand the Fundamental theorem of Algebra.

UNIT – I
FUNCTIONS OF A COMPLEX VARIABLE
Introduction – Continuity –Differentiability – Analyticity – Properties – Cauchy Riemann equations in Cartesian and Polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method.

UNIT – II
ELEMENTARY FUNCTIONS
Exponential, Trigonometric, Hyperbolic and Logarithmic Functions of complex variables, Real and Imaginary parts of the elementary functions and their properties.

UNIT – III
COMPLEX INTEGRATION
Integration of complex functions – Line Integrals, Cauchy's Integral theorem, Cauchy Goursat theorem, Cauchy's Integral Formula and Generalized Cauchy's Integral formula.

UNIT – IV
POWER SERIES
Sequence, Series and Power series of complex functions, Region of Convergence of the series, Taylor's series, Maclaurin's series and Laurent series of the complex functions. Zeroes and singularities of an analytic function – Types of singularities, Residues.

UNIT – V
RESIDUE THEOREM AND ITS APPLICATIONS TO REAL DEFINITE INTEGRALS
Residue theorem, Calculation of residues and evaluation of integrals using residue theorem. Evaluation of Real Definite Integrals of types $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ *and* $\int_{-\infty}^{\infty} f(x)\, dx$ using Residue theorem. Argument Principle, Fundamental theorem of Algebra and Rouche's Theorem

TEXT BOOKS

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. Dr. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH Publications, New Delhi, 2010.

REFERENCES

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi, 2011.
2. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley & Sons, New Delhi, 2011.
3. Peter O'Neil**, "***Advanced Engineering Mathematics*", 7th Edition, Cengage Learning, New Delhi, 2012.
3.

B.Tech. (IV Sem.) 17EC09 - ELECTROMAGNETIC FIELDS AND WAVES

L	T	P	Cr.
2	2	-	3

Pre-requisites : Vector Algebra, Coordinate Systems, Vector Calculus.

Course Educational Objective: This course provides the knowledge on electric and magnetic fields in both static and dynamic domains. The course will give an idea about application of Maxwell's equations with boundary conditions. The course also gives the complete information regarding the Electromagnetic wave propagation in different mediums.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	**Understand** the basic concepts of Electromagnetic fields in static and time varying conditions.
CO2	**Apply** Maxwell's equations in solving electromagnetic fields.
CO3	**Analyze** the characteristics of EM wave propagation in different media of dielectrics, free space, conductors.
CO4	**Evaluate** thecharacteristics of EM wave propagation between two media

UNIT-I

Electrostatics: Coulombs Law, Electric Field Intensity, Electric Field due to Continuous Charge Distributions- Line Charge, Surface Charge. Electric Flux and Electric Flux Density, Relation between E and D, Gauss's Law and its Limitation, Applications of Gauss's Law, Electric Potential, Relation between E and V. Maxwell's Two Equations for Electrostatic Fields, Electric Dipole and Dipole Moment, Electrostatic Energy and Energy Density, Conduction and Convection Currents, Poisson's and Laplace's Equations. Capacitance- Parallel Plate Capacitor, Coaxial Capacitor and Spherical Capacitor.

UNIT-II

Magnetostatics: Magnetic Field Intensity, Biot-Savart's Law, Ampere's Circuit Law, Applications of Ampere's Circuit Law, Magnetic Flux and Magnetic Flux Density, Maxwell's two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials. Force due to Magnetic Field- Force on a Charged Particle, Force on a Current Element, Force between Two Current Elements, Amperes Force Law, Concept of Inductance, Magnetic Energy and Energy Density.

UNIT-III

Maxwell's Equations: Introduction to Time Varying Fields, Continuity Equation, Faraday's Law, Inconsistency of Amperes Law, Displacement Current Density and Displacement Current, Differential and Integral Form of Four Maxwell's Equations. Boundary Conditions.

UNIT-IV

Electromagnetic Waves – I: Concept of Electromagnetic Wave, Waves in General- Wave Equations for Conducting Media, Wave Equations for Perfect Dielectric Media, Scalar Form of Wave Equations, Vector Form of Wave Equations, Uniform Plane Wave; Definitions- Propagation Constant, Attenuation Factor, Phase Constant, Intrinsic Impedance, Loss Tangent, Velocity and Wavelength of EM Wave; Wave Propagation in Lossy Dielectrics, Wave Propagation in Lossless Dielectrics, Wave Propagation in Free Space, Wave Propagation in

Good Conductors- Skin Depth; Concept of Polarization- Linear Polarization, Circular Polarization, Elliptical Polarization.

UNIT-V

Electromagnetic Waves – II: Poynting Vector, Time Average Power, Total Power Crossing the Surface, Poynting Theorem, Power Loss in a Plane Conductor. Reflection of a Plane Wave at Normal Incidence (Dielectric-Dielectric & Dielectric-Conductor Interface)- Incident Wave, Reflected Wave, Transmitted Wave, Reflection Coefficient, Transmission Coefficient, Standing Wave, Standing Wave Ratio. Reflection of a Plane Wave at Oblique Incidence (Parallel and Perpendicular Polarization) - Reflection Coefficient, Transmission Coefficient, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance.

TEXT BOOKS

1. Matthew N.O.Sadiku, "Principles of Electromagnetics", Oxford University Press, 4th Edition.
2. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education Publishers.

REFERENCE BOOKS

1. William Hayt, J A Buck, M JallelAkhtar "Engineering Electromagnetics", TMH Publishers, 8th Edition.
2. Edward C.Jordan and Keith G.Balmain "Electromagnetic waves and Radiating systems", PHI Publishers, 2rdEdition, 2001.
3. R.K.Shevgaonkar,"Electromagnetic waves", McGraw Hill education, 1st edition,2005.
4. David K Cheng, "Field and Wave Electromagnetics", Pearson education, 2nd Edition.
5. John D Kraus,Keith R.Carver"Electromagnetics"TMH Publishers.

B.Tech. (IV Sem.)	17EC10 - DIGITAL SIGNAL PROCESSING	L	T	P	Cr.
		2	2	-	3

Pre-requisites : Signals and Systems

Course Educational Objective : This course provides the knowledge on discrete time signals and systems in both time and frequency domains. The course will give an idea about various transformations like DTFT, DFT, FFT and DIT/DIF radix-2 algorithms. The course also gives the complete information regarding the design of both FIR and IIR filters.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Understand the fundamentals and properties of discrete time signals and systems
CO2	Analyze the various types of Discrete Time Signals and Systems in both time and frequency domain
CO3	Apply the Z-Transform techniques to solve discrete time signals and to realize Discrete Systems
CO4	Evaluate FFT radix-2 DIT and DIF algorithms, which are used to compute DFT of a sequence with reduced number of calculations
CO5	Design an IIR Digital Filters through Approximation Procedures and FIR Digital Filters through Window Techniques

UNIT-I Discrete Time Signals: Elementary Discrete Time Signals- Impulse, Unit Step, Unit Ramp, Rectangular, Decaying Exponential, Raising Exponential, Double Exponential; Representation of Discrete Time Signals- Graphical, Functional, Tabular and Sequence; Operations on signals- Time Shifting, Time Scaling, Time Reversal, Amplitude Scaling, Convolution; Properties of Signals- Even/Odd signals, Causal/Non-Causal Signals, Bounded/Unbounded Signals, Periodic/Aperiodic signals, Energy/Power Signals.
Discrete Time Systems: System Representation throughLCCDE- Impulse Response, Response of system; Properties of Discrete Time Systems- Linear and Nonlinear, Shift Invariant and Variant, Causal and Non Causal, Stable and Unstable.
Discrete Time Fourier Transform: DTFT of a Sequence, Magnitude Spectrum and Phase Spectrum; DTFT of a System, Frequency Response, Magnitude Response and Phase Response; Properties of DTFT- Linear, Periodicity, Time Shifting, Frequency Shifting, Time Reversal, Conjugate and Parseval's Theorem.

UNIT-II Z Transform: Z-Transform of Causal, Anti-Causal and Non-Causal Sequence. Region of Convergence and Properties; Properties of Z Transform- Linearity, Time Shifting, Time Reversal, Scaling in Z domain, Conjugate, Differentiation in Z domain, Time Convolution, Initial Value and Final Value Theorems; Z Transform of Various Classes of Signals; Inverse Z Transform Through Long Division, Partial Fractions and Residue Methods.
Realization of Discrete Systems: Direct Form-I, Direct Form-II or Canonic Form, Parallel Form and Cascade Form.

UNIT-III Discrete Fourier Transform: Concept of DFT, Computation of DFT, Computation of IDFT, Relation between DTFT and DFT, Properties of Twiddle factor, Properties of DFT- Linear, Periodicity, Time Shifting, Frequency Shifting, Time Reversal, Conjugate, Parseval's Theorem, Concept of Convolution, Linear Convolution, Circular Convolution, Linear Convolution through Circular Convolution, Response of the LTI System through Circular Convolution, Circular Convolution through DFT and IDFT, Linear Convolution through DFT and IDFT.

Fast Fourier Transform: Need of FFT, Radix-2 Decimation in Time FFT Algorithm, Radix-2 Decimation in Frequency FFT Algorithm, Comparison between DIT and DIF Algorithms, Inverse FFT.

UNIT-IV Filters: Concept of Filter, Characteristics of Filters, Classification of Filters- LPF, HPF, BPF, BEF; Analog and Digital Filters.
IIR Filter Design: Impulse Invariant Transformation - Aliasing Effect, Bilinear Transformation - Frequency Warping. Specifications of Low Pass Filter, Analog Butterworth Filter, Design of Low Pass Digital Butterworth Filter, Analog Chebyshev Filter, Design of Low Pass Digital Chebyshev Filter, Analog Frequency Transformations.

UNIT-V FIR Filter Design: Steps to design FIR Filters, Characteristics of FIR filters with linear Phase, Frequency Response Linear Phase FIR filters, Design of FIR filters- Fourier series method, Windowing Techniques-Rectangular Window, Hanning Window, Hamming Window, Blackman Window, Bartlet/Triangular Window, Comparison of various Window Functions, Comparison between FIR and IIR Filters.
Signal Processing: Digital Signal Processing System, Advantages of DSP, Limitations of DSP, Applications of DSP.

TEXT BOOKS

1. John G. Proakis, *"Digital Signal Processing"*, Principles, Algorithms & Applications, Pearson education, 4th edition, 2007.
2. Alan V Openheim, Ronald W. Schafer, *"Digital Signal Processing"*, PHI learning Pvt.Ltd, 1975.

REFERENCES

1. Manson H Hayes, *"Digital Signal Processing, Schaum's Outlines"*, TMH Publications, 2004.
2. Lonnine C. Ludeman, *"Fundamentals of Digital Signal Processing"*, John Wiley & Sons.
3. A. NagoorKani, *"Digital Signal Processing"*, RBA Publications, Chennai.
4. P. Ramesh Babu, *"Digital Signal Processing"*, Scitech Publications Pvt Ltd, Chennai.
5. Ananda kumar, *"Digital Signal Processing"*, PHI Publishers, New Delhi

B.Tech. (IV Sem.)	17EC11 - DIGITAL SYSTEM DESIGN	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Digital Electronic Circuits.

Course Educational Objectives: This course aims to provide the students to understand the concepts of CMOS logic families, HDLs, use of HDLs for designing the combinational and sequential circuits.

Course Outcomes (COs): At the end of the course, students will be able to:

CO1	Interpret the digital logic circuits using CMOS logic.
CO2	Understand the concepts of HDL languages.
CO3	Apply VHDL concepts for implementation of digital circuits.
CO4	Create the digital circuits using Verilog HDL.

UNIT-I

CMOS Logic Circuits: CMOS Logic Levels, CMOS Inverter, NAND, NOR, AND, OR, AOI, OAI Circuit Diagrams and Functional Tables.

VHDL Hardware Description Language: Design Flow, Program Structure, Types and Constants, Arrays, Functions and Procedures, Libraries and Packages with Examples, Structural Design Elements, Data Flow Design Elements, Behavioral Design Elements.

UNIT-II

Combinational & Sequential Logic Design using VHDL: Decoders-74x138, 74x139, Encoders-74x148 Priority Encoder, Multiplexers-74x151 MUX, Barrel shifter.

Sequential Logic Design using VHDL:8-Bit Latch 74x373,Flip Flops-D Flip Flop74X74,JK Flip Flop74X109, Counters- 74x163 4-Bit Binary Counter,74X163 as Mod-11 and Mod-193 Counter, universal Shift Register 74x194.

UNIT-III

Introduction to Verilog: Verilog as HDL, Levels of Design Description, System Tasks, Programming Language Interface, Test Benches, Language Construct and Conventions.

Gate Level Modeling: Introduction, Logic Gate Primitives, Module Structure, Tri-State Gates, Array of Instances of Primitives.

UNIT-IV

Switch level modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, CMOS NOT, NAND, NOR Gate Using Switch Primitives

Behavioral modeling: Introduction, Operations and Assignments, Functional Bifurcation, Constructs, Assignments with Delays, Wait Construct, Multiple Always Blocks and Designs at Behavioral Level. Blocking and Non-blocking Assignments, Case Statement, Simulation Flow.

UNIT-V

Data flow level modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

TEXT BOOKS

1. John F. Wakerly, *"Digital Design"*, Principles and Practices, Pearson education, 4th edition
2. T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL", Wiley IEEE Press.

REFERENCES

1. Charles H. Roth Jr., "Digital System Design Using VHDL", PWS Publications, USA, Reprint 2002.
2. Jan M. Rabaey, AnanthaChandrakasan, and BorivojeNikolic, "Digital Integrated Circuits: A Design Perspective", Prentice Hall Publishers.
3. K. C. Chang, "Digital Systems Design with VHDL and Synthesis: An Integrated Approach", Wiley-IEEE Computer Society Press.
4. Douglas J. Smith, HDL Chip Design, Doone Publications, USA.
5. Michael D.Ciletti, Advanced Digital Design with Verilog HDL,PHI Publishers.
6. J. Bhaskar, A Verilog Primier,BSP Publishers.
7. Bob zeidman, Verilog designers Library, Prentice Hall PTR Publishers.

B.Tech. (IV Sem.)	17EC12 - ANALOG COMMUNICATIONS	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Signals and Systems

Course Educational Objective: This course provides the knowledge on underlying concepts of various Analog Modulation Techniques, enlightens various elements in Transmitters & Receivers and their functionalities and evaluates the noise performance of various Analog Communication Systems.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understandthe basic concepts of analog communication.

CO2: Evaluate the performance of fundamental blocks constituting various analog modulation techniques.

CO3: Apply the principles of sampling in deriving different pulse modulation approaches.

CO4: Analyze the impact of noise in various analog communication systems.

UNIT-I Introduction to Communication System: Elements of Communication System, Need for Modulation, Classification of Modulation.
Amplitude Modulation: Definition, Time and Frequency Domain Representation, Single Tone Amplitude Modulation, Modulation Index, Power relations in AM wave, Generation of AM wave: Square Law Modulator, Switching Modulator, Detection of AM Wave: Square Law demodulator, Envelope Detector.
Double Side band Suppressed Carrier Modulation: Definition, Time and Frequency domain representation, Generation of DSBSC wave: Balanced Modulator, Ring Modulator, Coherent Detection of DSBSC wave, Effect of Phase and frequency Errors in the detection, Costas Loop.

UNIT-II Single Side band Modulation: Definition, Time and Frequency domain representation, Generation of SSB wave: Filter Method, Phase Discrimination, Coherent detection of SSB wave, Effect of Phase and Frequency Error in the detection.
Vestigial Side band Modulation: Definition, Time and frequency domain representation, Generation of VSB wave, Envelope detection of VSB wave plus carrier. Comparisons of amplitude modulation techniques.

UNIT-III Angle Modulation: Definition, Types of Angle Modulation, Frequency Modulation: Time domain representation, Single tone Frequency Modulation, Narrow Band Frequency Modulation: Time and Frequency domain representation, Wide band Frequency Modulation: Time and Frequency Domain representation, Transmission Band width of FM wave, Generation of FM wave: Direct method, Indirect method.
Demodulation of FM wave: Frequency Discrimination method: Simple slope detector, Balanced Slope detector, Phase Discrimination method: Foster Seeley Discrimination method, Ratio detector, Phase Locked Loop.

UNIT-IV Pulse Analog Modulation: Need for Pulse Modulation, Types of Pulse Analog Modulation**,** Pulse Amplitude Modulation: Definition, Generation of PAM wave: Ideal sampling, Natural Sampling, Flat top sampling, Demodulation of PAM wave, Pulse Width Modulation: Definition, Generation of PWM wave, Demodulation of PWM wave, Pulse Position Modulation: Generation of PPM wave, Demodulation of PPM wave.
Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing.

UNIT-V Radio Transmitters and Receivers: Radio transmitter introduction and classification, AM transmitters-low level and high level, FM transmitters: Direct and Indirect methods, Frequency stability in FM transmitters, Radio Receiver introduction and classification, Basic characteristics of receivers, Need of heterodyning, Super heterodyne Receiver, Concept of IF, Significance of AGC in AM Radio Receivers, FM Receiver-Importance of squelch circuit and amplitude limiting.

Noise in Analog Communication Systems: Definition, Classification of Noise,AM receiver Model, Signal to Noise ratio calculations in AM, DSBSC, SSBSC systems, FM receiver Model, Signal to Noise ratio in FM receiver, Threshold Effect, Pre-Emphasis and De Emphasis Circuits.

TEXT BOOKS

1. Simon Haykin, *"Communication Systems"*, John Wiley & Sons, 2nd Edition, 1983.
2. George Kennedy ,Davis, *"Electronic Communication Systems"*, Tata McGraw Hill Education, 4th edition, 1999

REFERENCES

1. G.K.Mithal, *"Radio Engineering", Khanna Publishers,20th Edition,2000*
2. Sanjay Sharma, *"Analog Communication Systems",*S.K.Katariya& Sons,2nd Edition, 2007

B.Tech. (IV Sem.)	17EC65 - DIGITAL SIGNAL PROCESSING LAB	L	T	P	Cr.
		-	-	2	1

COURSE OBJECTIVE: This course provides generation of basic signals and operations on signals. This course also provides design of IIR filters and FIR filters using windowing techniques

Course Outcomes (COs): At the end of the course, students will be able to

- **CO1** Understand the basics of MATLAB and Code Composer Studio
- **CO2** Analyze discrete time systems in both time and frequency domains
- **CO3** EvaluateLinear and Circular convolution using DFT and IDFT.
- **CO4** Design IIR and FIR Filters and obtain their frequency responses

LIST OF EXPERIMENTS

Part I: Experiments using MATLAB Software

(The following experiments are to be simulated using MATLAB/ SIMULINK Software)

1. Basic operations on Matrices.
2. (a) Generation of Various discrete time signals (b) Operations on signals
3. (a) Linear Convolution (b) Linear and Convolution through DFT and IDFT.
4. (a) Circular Convolution (b) Circular Convolution through DFT and IDFT.
5. Computation of N-Point DFT and IDFT.
6. Power Spectral Density for sinusoidal signal.
7. Frequency response of analog low pass & high pass filter.
8. Design of IIR butter worth filters (LPF, HPF, BPF, and BSF).
9. Design of IIR Chebyshev filters (LPF, HPF, BPF, and BSF).
10. Design of FIR filters using window techniques.
11. Design of Digital IIR filters using Bi-linear transformation.

Part II: Experiments using Code Composer Studio Simulation Soft ware

(The following experiments are to be simulated using Code Composer Studio Software)

12. Linear Convolution.
13. Implementation of a FIR filter.
14. Implementation of an IIR filter.
15. Computation DFT through FFT.

L	T	P	Cr.
-	-	2	1

B.Tech. (IV Sem.) **17EC66 - DIGITAL SYSTEM DESIGN LAB**

Course Educational Objectives: This lab provides practical exposure in Xilinx compiler and in-built simulator to describe the simulation of digital circuits using HDL and explain VHDL programs to generate test bench simulation.

Course Outcomes (COs): At the end of the course, students will be able to

CO1 Understand the functionality of logic gates using HDL simulator.

CO2 Analyze the digital circuits using HDL simulator.

CO3 Evaluate the functionality of memories using HDL simulator.

Pre-requisites: Digital Electronics.

Minimum 12 experiments to be conducted

1. Implementation of Logic Gates – data flow model and behavioural model
2. Combinational logic circuits – adders and subtractor
3. Code converters- binary to gray and gray to binary
4. 3 to 8 Decoder – 74138.
5. 4 Bit Comparator – 7485.
6. 8 x 1 Multiplexer – 74151 and 2X4 Demultiplexer – 74155
7. 16 x 1 Multiplexer – 74150 and 4X16 Demultiplexer – 74154
8. Sequential circuits - Flip-Flops
9. Decade counter – 7490.
10. Synchronous & Asynchronous Counters
11. Shift registers – 7495.
12. Universal shift registers – 74194/195.
13. RAM (16 x 4) – 74189 (Read and Write operations).
14. Stack and Queue Implementation using RAM.

B.Tech. (IV Sem.) **17EC67 - ANALOG COMMUNICATIONS LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites: signals and systems

Course Educational Objective: This course provides thepractical exposure on analogmodulation schemes, use of filters for improving the performance of frequency modulation, use of nonlinear device for generating multiple frequency components and knowledge on MATLAB to verify the simulated results of analog modulation schemes.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Analyze the practical aspects of various analog modulation schemes.

CO2: Evaluate the various measures that improve receiver performance.

CO3: Apply the programming aspects of MATLAB in simulating various analog modulation techniques.

LIST OF EXPERIMENTS:

PART-A

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Balanced modulator and Synchronous detector.
4. SSB modulation and Demodulation.
5. Pre-emphasis and de-emphasis.
6. Phase Locked Loop.
7. Characteristics of Mixer.
8. PAM modulation and demodulation.
9. PWM and PPM modulation and demodulation.
10. Sampling theorem verification.

PART-B (USING MATLAB communication toolbox and simulink)

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Balanced modulator and Synchronous detector.
4. PAM modulation and demodulation.
5. PWM and PPM modulation and demodulation

B.Tech. (V Sem.)	17HS01 - ENGINEERING ECONOMICS AND ACCOUNTANCY	L	T	P	Cr.
		3	-	-	3

Prerequisite: Basic Sciences and Humanities

Course Objective: The objective of this course is to inculcate basic knowledge to students relating to concepts of Engineering Economics and Accountancy to make them effective business decision makers.

Other course educational objectives of this course:

1. To know the concepts of engineering economics and to make them effective business decision makers.
2. To understand the concepts of production and cost for various business decision.
3. To understand the different types of market, market structures & pricing strategies and their applications in business decision making.
4. To explain the strategies of raising and utilization of business capital.
5. To understand the Fundamental of accounting and analysis of accounting statements for managerial decision making.

Course Outcomes: After completion of the course, students will be able to

CO1: Capable of analyzing fundamentals of economics concepts which helps in effective business administration.
CO2: Discuss cost- output relationship in business operations.
CO3: Analyze the features of market structures and present the pricing policies.
CO4: Identify the types of Business organization of the company and the implementation requirements of each one.
CO5: Financial position of the company can be analyzing with the help of financial statements.

UNIT - I

Introduction to Engineering Economics: Economics – Definitions- Nature and Scope - Branches economics – Engineering Economics-features & Scope

Demand Analysis: Demand- Types of demand- Determinants- Law of Demand -Elasticity of demand – significance -Types of Elasticity of Demand.

Demand Forecasting-Types- Factor governing - Methods of demand Forecasting.

UNIT - II

Theory of Production and Cost Analysis: Production Function – Isoquant and Isocost, MRTS, Least Cost Combination of Inputs. Laws of Returns, Internal and External Economies of Scale.

Cost Analysis: Cost concepts, Cost & output relationship in short run & long run, Break-even Analysis (BEA)-Determination of Break-Even Point - Significance and limitations.

UNIT – III

Markets & Pricing Policies:

Market structures: Markets-Types of markets - Features and price out determinations under Perfect competition, Monopoly, Monopolistic Competition, oligopoly markets.

Pricing –Pricing polices & its Objectives – Pricing Methods and its applications in business.

UNIT - IV

Capital and Capital Budgeting: Capital and its significance-Types of Capital-Estimation of Fixed and Working capital –working capital -Components of working capital & Factors determining the need of working capital.- Sources of raising capital

Capital budgeting-Significance –Process- Techniques of Capital Budgeting (non-discounted cash flow techniques and discounted cash flow of techniques).

UNIT - V

Financial Accounting and analysis: Accounting –significance -- Book Keeping-Double entry system –Journal- Ledger- Trial Balance- Final Accounts with simple adjustments.

Financial Statement Analysis through ratios: Ratio-analysis of financial statement using different ratios (Liquidity -Profitability- Solvency -Activity ratios).

TEXT BOOK

Aryasri: Managerial Economics and Financial Analysis, MHE, 2014.

REFERENCES

1. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2003.
2. AmbrishGupta,Financial Accounting for Management, Pearson Education, New Delhi.
3. Lipey&Chrystel, Economics, Oxford University Press.
4. Domnick Salvatore: Managerial Economics in a Global Economy,4th Edition,Thomson.

B.Tech. (V Sem.)	17EC13 - COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Digital Electronic Circuits

Course Educational Objectives:
This course will introduce students, the fundamental concepts underlying modern computer organization and architecture. Main objective of the course is to familiarize students about hardware design including logic design, basic structure and behavior of the various functional modules of the computer and how they interact to provide the processing needs of the user. It will cover computer arithmetic, CPU structure and functions, memory system organization and architecture, system input/output.

Course Outcomes (COs): At the end of the course, students will be able to:

CO1:	Understand the functional units and the interactions between them of a general purpose computer system.
CO2:	Analyze the organizational aspects of Arithmetic unit of a CPU with respect to Addition, Subtraction, Multiplication and division operations on integer and floating point operands.
CO3:	Apply the design methods of hardwired and micro programmed control units to study the control unit organization.
CO4:	Evaluate the performance of primary/ secondary memory systems and communication aspects of I/O units with CPU by the study of interrupt, DMA and the interfacing of aspects of standard interfaces.

UNIT-I:
Basic Structure of Computers: Introduction, Functional Units: Input Unit, Memory Unit, ALU, Output Unit, Control Unit; Stored Program Concept, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multicomputers.

UNIT-II:
Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders: Carry-Lookahead Addition; Multiplication of Positive Numbers, Signed-Operand Multiplication: Booth's Algorithm; Integer Division, Floating Point Numbers and Operations: IEEE Standard for Floating Point Numbers.

UNIT-III:
Control Unit: Fundamental Concepts, Micro-Operations: Fetch Cycle, Indirect Cycle, Interrupt Cycle, Execute Cycle, Instruction Cycle; Control of the Processor, Hardwired Control Implementation: Control Unit Inputs, Control Unit Logic; Microprogrammed Control: Microinstructions, Microprogram Sequencing, Branch Addressing, Microinstructions with Next Address Field, Prefetching Microinstructions.

UNIT-IV:
The Memory System: Basic concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT-V:

Input / Output Organization: Introduction, External Devices, I/O Modules, Programmed I/O, Interrupt Driven I/O, Direct Memory Access, I/O Channels and Processors, Standard I/O Interfaces: PCI Bus, SCSI Bus, USB.

TEXT BOOKS

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", McGraw Hill Education, 5th Edition.
2. William Stallings, "Computer Organization and Architecture Designing for Performance", Pearson Education, 8th Edition, 2013.

REFERENCE BOOKS

1. John P. Hayes, "Computer Architecture and Organization", McGraw Hill Education, 3rd Edition.
2. Andrew S. Tanenbaum, "Structured Computer Organization", Pearson/PHI Publishers.
3. M. Morris Mano, "Computer System Architecture", Pearson, 3rd Edition.

B.Tech. (V Sem.) 17EC14 - TRANSMISSION LINES AND WAVE GUIDES

L	T	P	Cr.
2	2	-	3

Pre-requisites :: Basics of circuit theory ,vector calculus, Basics of Electromagnetics , Concept of Reflection

Course Educational Objective: This course provides the knowledge on different types of transmission lines, wave guides, resonators and microstrip lines. The course will give an idea about transmission lines parameters, characteristics, matching of impedances and field analysis of transmission lines and waveguides. This course will help in the design of a transmission line chosen for specific application and use the Smith chart to find reflection coefficient, VSWR, impedance.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Understand the characteristics of the transmission lines
CO2	Evaluate reflection coefficient, VSWR, impedances using Smith chart
CO3	Apply field equations to obtain parameters of Rectangular and Circular wave guides
CO4	Analyze the characteristics of Cavity resonators
CO5	Design a Microstrip lines for a given specifications

UNIT-I

TRANSMISSION LINES-I: Types, Parameters, Transmission line equations, Primary and Secondary Constants, Expressions for Characteristic Impedance and Propagation Constant, Infinite Line Concepts, Lossless, Low loss, Distortion less Transmission lines, Loading of Lines and its types.

UNIT-II

TRANSMISSION LINES-II: Input Impedance relations, Reflection Coefficient, VSWR, Short Circuit and Open Circuit Lines, UHF Lines as Circuit elements, Matched Lines-$\lambda/4$, $\lambda/2$, $\lambda/8$ lines, Impedance Transformations , Power in a Transmission line, Smith Chart–Applications of the Smith Chart, Quarter wave transformer, single stub matching and double stub matching, Losses in Transmission lines.

UNIT-III

GUIDED WAVES: Waves between parallel plates of perfect conductors, Transverse electric and transverse magnetic waves, characteristics of TE and TM Waves, Transverse Electromagnetic waves, Velocities of propagation, Attenuation of TE and TM waves in parallel plate guides, Wave impedances.

RECTANGULAR WAVEGUIDES: Transverse Magnetic Waves in Rectangular Wave guides, Transverse Electric Waves in Rectangular Waveguides, Field Expressions in both cases, characteristics of TE and TM Waves -Cutoff wavelength , phase velocity, group velocity, guided wave length, free space wave length, Impossibility of TEM waves in waveguides, Dominant mode in rectangular waveguide, Attenuation of TE and TM modes in rectangular waveguides, Wave impedances for TE and TM cases, Excitation of modes.

UNIT-IV

CIRCULAR WAVE GUIDES: Bessel functions, Solution of field equations in cylindrical co-ordinates, TM and TE waves in circular guides, Field Expressions in both cases, wave impedances and characteristic impedance, Dominant mode in circular waveguide, Excitation of modes.

RECTANGULAR CAVITY RESONATORS: Rectangular cavity resonators, Derivation of Field expressions, Q factor of a Rectangular Cavity resonator.

UNIT-V

CIRCULAR CAVITY RESONATORS: Circular cavity resonators, Derivation of field expressions, Q factor of a Circular Cavity resonator, Re-entrant Cavities.

MICROSTRIP LINES: Characteristic impedance of Microstrip lines, Effective Dielectric constant, Losses in Microstrip lines, related expressions, Quality factor of Microstrip lines.

TEXT BOOKS

1. Matthew N.O.Sadiku, "Elements of Engineering Electromagnetics", Oxford University Press, 4th Edition.
2. K.D Prasad, "Antennas and Wave Propagation", Satya Prakashan Publishers.

REFERENCES

1. Peter. A. Rizzi, "Microwave Engineering: Passive Circuits", PHI Publishers.
2. M. L. Sisodia and G. S. Raghuvanshi, "Microwave Circuits and Passive Devices", New Age International Publishers.
3. Samuel Y. Liao, "Microwave Devices and Circuits", PHI Publishers.
4. Umesh Sinha, **"**Transmission Lines and Networks", Satya Prakashan Publishers.
5. Edward. C. Jordan and Keith G. Balmain **"**Electromagnetic Waves and Radiating systems", PHI Publications.
6. David M. Pozar, "Microwave Engineering", John Wiley Publishers.

L	T	P	Cr.
2	2	-	3

B.Tech. (V Sem.) **17EC15 - DIGITAL COMMUNICATIONS**

Pre-Requisites: Analog Communications

Course Educational Objective: This course provides the knowledge on different digital modulation techniques. The course provides different concepts on information theory, block codes and convolution codes. It also gives the complete information regarding the design of optimum receivers for digital communication systems and their performance analysis.

Course Outcomes (COs): At the end of the course, student will be able to

CO1: Comparevarious pulse digital modulation techniques.
CO2: Analyze the underlying concepts of digital modulation techniques.
CO3: Evaluate digital modulation techniques for optimal reception.
CO4: Design the source coding techniques based on the concept of information theory.
CO5: Apply linear block codes and convolution codes for the channel coding.

UNIT – I

Pulse Digital Modulation: Advantages of Digital Communications, Elements of a Digital Communication System, Sampling of signals, Quantization of signals- Quantization noise, Quantization error, Pulse Digital Modulation Systems: Pulse Code Modulation-PCM System, Encoding, Regenerative repeaters, Decoding, Reconstruction, effect of noise in PCM-Calculation of output SNR in PCM, Multiplexing of PCM Signals, Synchronization; Need for non uniform quantization- Companding- Block diagram, μ-law, A-law; Differential Pulse Code Modulation-Transmitter, Receiver; Delta Modulation-Transmitter, Receiver, effect of noise in DM; Adaptive Delta Modulation- Transmitter, Receiver Block diagram, operation; Comparison of PCM and DM.

UNIT – II

Digital Modulation Techniques: Introduction to Digital Modulation, Wave form representation of different digital modulation techniques; Phase Shift Keying- Binary Phase Shift Keying, Mathematical representation, Transmitter, Receiver; Differential PSK- waveforms to represent DPSK; Quadrature Phase Shift Keying- Mathematical representation, Transmitter, Receiver; Frequency Shift Keying-Binary FSK, Mathematical representation, Transmitter, Receiver; Amplitude Shift Keying- Transmitter, Receiver, constellation diagrams and Band width requirements of Digital Modulation schemes.

UNIT – III

Optimal Reception of Digital Signal: Base Band Signal Receiver, Optimum Receiver-Calculation of Optimum Filter transfer function, Optimum Filter Realization using Matched Filter, Probability of error for matched filter, Optimum filter realization using correlator, Optimal of coherent reception: probability of error for BPSK, BFSK, QPSK, Comparison of Digital Modulation Systems.

UNIT – IV

Information Theory and Source Coding: Discrete message and information content, Concept of amount of Information- Average Information, Entropy, Information Rate, Mutual Information and its properties; Source Coding to increase Average Information per bit- Source coding theorem, Shannon-Fano Coding, Huffman Coding; Channel Capacity of Gaussian Channel-Band width-S/N trade off.

UNIT – V

Linear Block Codes and Convolution Codes: Introduction, Linear Block codes- matrix description of Linear Block codes, error detection and error correction capabilities of Linear block codes, Properties of Linear Block Codes, Syndrome Decoding, Hamming codes; Binary Cyclic Codes- Algebraic structure, Systematic and Non Systematic form, Encoding, Syndrome calculation; Convolution Codes- Encoding of Convolution Codes- Time domain approach, Transform domain approach and Graphical approach- State diagram, Code tree and Trellis diagram; Decoding of Convolution Codes- Viterbi decoding algorithm.

TEXT BOOKS

1. Simon Haykin, *"Digital Communications",* John Wiley & sons, 2nd Edition.
2. Taub and Schilling, *"Principles of Communication Systems"*, TMH Publications, 3rd edition.

REFERENCES

1. J. S. Chitode, *"Digital Communications",* Technical Publications, first edition.
2. V. Chandra Sekar**,** *"Communication Systems",* Oxford University Press**.**

B.Tech. (V Sem.)	17EC16 - VLSI DESIGN	L	T	P	Cr.
		3	-	-	3

Prerequisite: Analog Electronics and Digital Electronics.

Course Educational Objective: This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential subsystem CMOS circuit designs used in VLSI Design. The course also gives the complete information regarding Floor planning methods in Chip Design.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Remember IC fabrication process and properties of MOSFET

CO2: UnderstandCMOS, NMOS design rules and layouts

CO3: Apply the concepts of logic gates and combinational circuits used in ICs

CO4: Create subsystem using combinational and sequential circuits.

CO5: Analyze chip design methods.

UNIT-I

IC fabrication Technology: Silicon semiconductor technology: wafer processing, oxidation, epitaxy, lithography, ion implantation, and diffusion, the silicon gate process: NMOS fabrication, CMOS fabrication, BICMOS technology. Comparison between CMOS and bipolar technologies.

Basic Electrical Properties of MOS and Bi-CMOS Circuits: $\mathbf{I_{ds}}$ $\mathbf{-V_{ds}}$relationships, MOS transistor threshold Voltage, $\mathbf{g_m}$, $\mathbf{g_{ds}}$, figure of merit $\boldsymbol{\omega_0}$, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design. Bi-CMOS Inverters.

UNIT-II

VLSI Circuit Design Processes: VLSI design flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 5μm CMOS Design rules for wires, Contacts and Transistors. Layout Diagrams for NMOS , CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Basic Circuit Concepts: Sheet Resistance R_s and its concepts to MOS, Area Capacitance calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out.

UNIT-III

Gate level Design: Logic gates, combinational logic functions, static complementary gates, switch logic, alternative gate circuits, low power gates, delay through resistive interconnect and delay through inductive interconnect.

Combinational Logic Networks: standard cell based layout, simulation combinational network delay, logic and interconnect design, and power optimization.

UNIT-IV

Sequential Machines: Latches and Flip-Flops, Sequential Systems and Clocking Disciplines, Sequential System Design, Power Optimization, Design Validation, Sequential Testing.

Subsystem Design: Subsystem design flow, carry-look-aheadadder, 4x4 array multiplier, Shifters: design of 4x4 barrel shifter, Zero/One Detectors, Design of 4bit ALU using adder, synchronous up/down counters , registers and High Density Memory.

UNIT-V

Floor planning: Introduction, Floor planning Methods, Global interconnect, Floor plan designs and Off-Chip Connections.

Chip Design: Design methodologies, Kitchen timer chip and Microprocessor data path. Concepts of FPGA and CPLD.

TEXT BOOKS

1. Kamran Eshraghian, EshraghianDougles and A.Pucknell, Essentials of VLSI circuits and systems, PHI Publishers, 2005.

2. Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.

REFERENCES

1. Neil. H. E. Weste and KamaranEshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rd Edition.

2. John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley Publishers.

3. M.SZE, VLSI Technology,2nd Edition, TMH Publishers

B.Tech. (V Sem.) 17EI18 - MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	Cr.
	3	-	-	3

Prerequisite: Applied Physics, Transducers, VLSI Design.

Course Educational Objective (CEO) :In this course students will learn aboutfundamentals of Micro-Electro-Mechanical-Systems, importance of miniaturization, scaling laws, fabrication process such as Bulk & Surface Micromachining including structures and working details of MEMS based devices.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:
CO1: Interpret the micro systems, micro electronics& miniaturization technique.
CO2: Apply the scaling laws to micro systems for providing information of downscaling.
CO3: Illustrate the Bulk and Surface micromachining techniques.
CO4: Classify and discuss the properties of different materials.
CO5: Analyze design aspects, working principles and limitations of MEMS based devices.

UNIT – I:OVERVIEW OF MEMS&SCALING LAWS IN MINIATURIZATION
MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization.
SCALING LAWS IN MINIATURIZATION
Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces.MEMS Design Considerations.

UNIT – II:MICRO FABRICATION -I
Introduction, Photolithography, Photoresist and Application, Light Sources, Photoresist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD), Sputtering, Deposition by Epitaxial, Etching.

UNIT – III: MICRO FABRICATION - II
Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison.
Surface Micromachining: Process, Associated Mechanical Problems (Adhesion, Interfacial stresses, Stiction), LIGA Process, MEMS Packaging.

UNIT – IV: MATERIALS FOR MEMS:
Introduction, Substrates & wafers, Active Substrate Materials, Silicon as a Substrate Material, Silicon Compounds, Piezoelectric Crystals, Polymers, Packaging Materials.

UNIT – V: MEMS DEVICES AND STRUCTURES
Micro sensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.
Micro actuation: Actuation using thermal forces, Piezoelectric crystals, MEMS with micro actuators: Microgrippers, Micromotors, Microgears, Micropumps.

TEXT BOOK
1. Tai-Ran Hsu, "MEMS & Microsystems: Design, Manufacture and Nanoscale Engineering", John Wiley & Sons, New Jersey, 2nd Edition, 2008.
2. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, "Micro and Smart Systems", John Wiley & Sons, India, 2010.

REFERENCES

1. Mark Madou, "Fundamentals of Micro fabrication", CRC Press, New York, 1997.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press, New York, 1997.
3. Julian W Gardner, "Micro sensors: Principles and Applications", John Wiley & Sons, 1994.
4. Sze S M, "Semiconductor Sensors", Tata McGraw-Hill, New Delhi, 1994.
5. C.Y. Chang and S.M. Sze, "VLSI Technology", Tata McGraw-Hill, New York, 2000.
6. Dilip Kumar Bhattacharya,Brajesh Kumar Kaushik, "MicroElectromechanicalSystems",CL India; 1st Edition,2014.

B.Tech. (V Sem.)	17EC17 - PCB DESIGN	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Engineering Physics, Engineering Chemistry, Electronic Circuit Analysis.

Course Educational Objectives: The course will provide design process and PCB manufacturing procedure further included an introduction to Packaging and Interconnecting Structures, Mechanical, Electrical and Manufacturing design considerations.

Course Outcomes (COs): At the end of the course, students will be able to:

CO1	Understand the basics of Printed circuit boards.
CO2	Identify the characteristics of Printed circuit boards.
CO3	Analyze the design of various circuit layouts on Printed circuit boards.
CO4	Create circuits on Printed circuit boards.
CO5	Evaluate the testing of Printed circuit boards.

UNIT-I

Types of Printed Wiring Boards: Introduction, Classification of Printed Wiring Boards, Basic PWB Classifications, Organic and Nonorganic Substrates, Graphical and Discrete-Wire Boards, Graphical Interconnection Board, Rigid and Flexible Boards, Graphically Produced Boards, Single-Sided Boards (SSBs) , Double-Sided Boards, Multilayer Boards (MLBs), Moulded Interconnection Devices, Platter-Through-Hold (PTH) Technologies, Subtractive and Additive Processes, Pattern Plating, Panel Plating, Additive Plating,

UNIT-II

Physical Characteristics of PCB: Classes of PCB Designs, Characteristics of Analog, RF and Microwave PCBs, Single- and Double-Sided PCBs, Multilayer PCBs, Flexible Circuits, Flexible Rigid, Backplanes, MCMs (Multichip Modules), Methods of Attaching Components, Through, Component Package Types, Materials Choices, Embedded Components Materials , Lamination , Trading Off Number of Layers Against Area , One PCB vs. Multiple PCBs.

UNIT-III

PCB Design Process: Objective of the PCB Design Process , Design Processes , System Specification , System Block Diagram, Partitioning System into PCBs , Determining PCB Size, Creating the Schematic, Building Component Libraries, Simulating Design, Placing Components on PCBs, Sequencing Nets to High-Speed Rules, Simulating Timing and Transmission Lines Effects, Adjusting Sequencing and Placement, Testing routability of Placement , Routing PCB, Checking Routed Results, PCB Characteristics, Spacing and Width Rules,

UNIT-IV

Multilayer Design Issues and Planning for Design: Reliability Issues , Substrate Flaws, Copper Surface Damage, Mechanical Problems , Internal mis-registration, Connection Flaws, Electrical Performance, Controlled Impedance (CI), Signal Attenuation at High Frequency, Signal Coupling at High Frequencies, Design Planning and Predicting Cost Design Planning and Manufacturing Planning , Planning Elements , Planning Concepts, New Product Design Expanded Design Process, Product Definition , Layout Efficiency, Selecting Design Rules

UNIT-V

Design for Testing: Introduction, Definitions, Ad Hoc Design for Testability, Physical Access, Logical Access, Structured Design for Testability, Standards-Based Testing, IEEE 1149.1, Boundary-Scan for Digital Circuits, IEEE 1149.4, Boundary-Scan for Mixed-Signal Circuits.

TEXT BOOK

CLYDE F. COOMBS, JR. Printed Circuits Handbook 5th ed , McGraw-Hill, 2001.

REFERENCES

1. Mr. Elanjeliyan,Prabhu and ManikandaPrabhu, PCB Designing and Fabrication
2. **Walter Bosshart, Printed Circuit Boards, McGraw Hill Education (16 June 1983)**
3. CLYDE F. COOMBS, JR. Printed Circuits Handbook, 6th Edition.
4. R. S. Khandpur, Printed Circuit Boards : Design, Fabrication, Assembly and Testing 1st edition

B.Tech. (V Sem.)	17EC18 - ADVANCED COMMUNICATIONS	L	T	P	Cr.
		3	-	-	3

COURSE OBJECTIVE: This course provides the knowledge on Display technologies, Mobile Telephone technologies, Battery technologies, USB and Cable technologies. This course also deals with Flexible electronics.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Relate the working of different Mobile Phone Processors

CO2: Understand the concepts of different display technologies used in Computers and Mobile Phones

CO3: Analyze the working principle of different batteries used in Mobile Phones, Computers

CO4: Compare the different Technologies used in USBs and Connectors

CO5: Design flexible electronic devices

UNIT-I

Mobile Telephone Technology

Mobile Phone Processors-ARM, Intel, Qualcomm Snapdragon, Huwaei Kirin, Samsung Exynos, Mediatek, NividiaTegra, Apple, Xiaomi Surge Processors, FinFET Technology.

UNIT-II

Display Technology

Displays used in Computers, Mobile Phones, LCD,LED,OLED, Q-LED Displays, Flat Panel, IPS Displays.

UNIT-III Battery Technology

Working principle of different batteries like Lion Batteries, Rechargeable batteries, Batteries used in Mobile Phones, Computers, Cars, Home Inverters.

UNIT-IV USBs, Connectors and Cable Technology

Different types of USBs-Micro USB, USB 2.0, USB 3.0,On The Go USB used in Computers, Mobile Phones, Television, Different types of Connectors-VGA, HDMI Connectors used in Television, Computers, Cables used for Television, LCD Projector and their features.

UNIT-V Flexible Electronics

Materials for Flexible Electronics Active Components and Substrates, Processing and characterization methods, Flexible and Organic Photovoltaics-Fundamentals of Photovoltaics, Organic Solar Cells, Flexible Solar cells, Flexible Electronic Devices-TFTs, Sensors, Displays, Memories, Batteries.

TEXT BOOKS

1. Joseph A. Castellano, Handbook of Display Technology**,** Academic Press

2. H.A. Kiehne, Battery Technology Hand Book, CRC Press

REFERENCES

1. Websites ofARM, Intel, Qualcomm Snapdragon, Huwaei Kirin, Samsung Exynos, Mediatek, Apple, NividiaTegra, Xiaomi Surge Processors
2. Jiun-Haw Lee, David N. Liu, Shin-Tson Wu,Introduction to Flat Panel Displays, Wiley-SIDSeries in Display Technology, John Wiley Publications.
3. Gholam-Abbas Nazri,GianfrancoPistoia,Lithium Batteries: Science and Technology, Springer Publications
4. Steven McDowell, Martin D.Sever,USB Explained, Prentice Hall Publishers
5. Mario Caironi, Yong-Young Noh, Large Area and Flexible Electronics, John Wiley Publications

B.Tech. (V Sem.)	17EC19 - ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Signals and Systems, Probability and Random Processes, Digital Signal Processing

Course Educational Objective: This course provides the knowledge on random signals, correlations functions and power spectra. The course will give an idea about linear prediction models. The course also gives non-parametric methods and parametric methods for Estimation of Power Spectrum.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand about random signals, correlation functions and power spectra.

CO2: Analyze forward and backward linear prediction models.

CO3: Apply concept of normal equation solution and analyze Wiener Filter.

CO4: Evaluate Power Spectrum by parametric methods and non-parametric methods.

UNIT - I: Random Signals, Correlations functions and Power Spectra

Random processes, Stationary random processes, Statistical Averages, Statistical Averages for Joint Random Processes, Power density spectrum, and Discrete-Time signals, Time Averages for Discrete-Time Random Processes, Mean-Ergodic Process, and Correlation-Ergodic processes.

UNIT -II: Linear Prediction

Innovations representation of a stationary random process: Rational power spectra, relationships between the filter parameters and the autocorrelation sequences, forward linear prediction, backward linear prediction.

UNIT –III: Normal Equations and Wiener Filters

Solutions of Normal equations: Levinson-Durbin Algorithm, FIR Wiener Filter, Orthogonality Principle in Linear Mean-Square Estimation, IIR Wiener Filter, Noncausal Wiener Filter.

UNIT –IV: Nonparametric Methods for Power Spectrum Estimation

The Bartlett Method: Averaging Periodograms, The Welch Method: Averaging Modified Periodograms, The Blackman and Tukey Method: Smoothing the Periodogram, Performance Characteristics of Nonparametric Power Spectrum Estimators.

UNIT –V: Parametric Methods for Power Spectrum Estimation

Relationships Between the Autocorrelation and the Model Parameters, The Yule-Walker Method for the AR Model Parameters, The Burg Method for the AR Model Parameters, Unconstrained Least-Squares Method for the AR Model Parameters.

TEXTBOOKS

J.G.Proakis& D. G. Manolokis, "Digital Signal Processing: Principles, Algorithms and Applications", PHI Publishers.

REFERENCES:

1.Alan V Oppenheim & Ronald W Schaffer- "Discrete Time signal processing", PHI Publishers.
2.Dimitris G. Manolakis&Vinay K. Ingle "Applied Digital Signal Processing" Cambrige university press

B.Tech. (V Sem.)	17EC90 - ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (Add on course – I)	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITES: Basic knowledge about Instruments

COURSE OBJECTIVE: This course provides the knowledge on basic characteristics of instruments, voltmeter, ammeter and ohmmeter and various methods of signal generation. This course will give an idea about measuring electrical parameters like R, L, C, f, Q, etc. using bridges and wave analyzers. This course provides knowledge about oscilloscopes, different types of transducers in detail.

Course Outcomes (COs): At the end of the course, students will be able to

- **CO1:** Understand the concepts of measurements and working principles of Voltmeters, Ammeters,Bridges and Oscilloscopes.
- **CO2:** Analyze the working of different signal generators and wave analyzers.
- **CO3:** Apply appropriate passive or active transducers for measurement of physical parameters.
- **CO4:** Design various aspects of measuring instruments.

UNIT-I

Characteristics of Instruments: Static characteristics-Accuracy, Resolution, Precision, Expected Value, Error, Sensitivity; Dynamic characteristics-Speed of response, Fidelity, Lag, Dynamic error; Errors in Measurement-Absolute Error, Percentage of Error; Types of Errors-Gross errors, Systematic errors, Random Errors.

DC Voltmeters: PMMC Movement, Basic Meter as DC Voltmeter, Multirange Voltmeter, Extending Voltmeter ranges, Concept of loading and Sensitivity; Types of DC Voltmeters- solid state voltmeter, Basic Differential Voltmeter, Laboratory DC Standard Differential Voltmeter.

AC Voltmeters- AC Voltmeter using half wave and full wave rectifiers, Multirange AC Voltmeter, Average Responding Voltmeter and Peak Responding Voltmeter, True RMS voltmeter.

UNIT – II

Ammeters: DC Ammeter-Basic Meter as DC Ammeter, Multirange Ammeter, Aryton Shunt Ammeter, and Extending Ammeter ranges; AC Ammeter- RF Ammeter using Thermocouple instruments.

Ohmmeters: Series and Shunt Type Ohmmeters;

Multimeters: Measurement of Voltage, Current, Resistance.

AC Bridges: Measurement of Impedance-Wheatstone Bridge; Measurement of Inductance-Maxwell's bridge, Anderson Bridge. Measurement of Capacitance- Schering Bridge, Wien Bridge; Errors and precautions in using bridges, Q-meter, Wagner earth (ground) connection meter.

UNIT-III

Signal Generators: Fixed and variable AF Oscillator, Standard Signal Generator, Modern Laboratory Signal Generator, AF Sine and Square wave Generator, Function Generator, Square and Pulse Generator, Random noise Generator, Sweep Generator, Arbitrary Waveform Generator.

Wave Analyzers: Frequency selective wave analyzer, Heterodyne wave analyzer, Distortion analyzer-Harmonic distortion analyzer; Spectrum analyzer.

UNIT-IV

Oscilloscopes: Basic principle of operation CRT, CRT features, Block diagram of Oscilloscope, Vertical Amplifier: Block diagram of Vertical Amplifier, Horizontal Deflection System-Sweep/Time Base Generator, Triggered pulse circuit. Delay line in Triggered sweep, Dual Beam CRO, Dual Trace Oscilloscope, Measurement of Amplitude and Frequency; Sampling Oscilloscope, Analog and digital Storage Oscilloscope, lissajous method of frequency measurement, standard specifications of CRO.

Probes for CRO (Active and Passive)-Direct Probes (1:1), High impedance probe (10X), Active probe, Attenuators-Uncompensated Attenuator, Simple compensated Attenuator.

UNIT-V

Transducers: Parameters of a transducer, advantages of transducers, Classification of transducers, Resistive transducer, Strain Gauge, Thermistors, Sensistors, Resistance thermometer Inductive transducer, LVDT, Capacitive transducer, Piezo electric Transducer, Photo electric Transducer, Temperature measurement Transducers-Thermocouple.

Displacement Measurement-Translational and Rotational displacement Transducers, Linear Velocity Measurement-Moving coil type and Moving magnet type.

TEXT BOOKS

1. H S Kalsi, Electronic Instrumentation, Tata Mc Graw Hill Publishers, 3rd Edition.
2. Albert.D. Helfrick and Willam D. Cooper, Modern Electronic Instrumentation and Measurement Techniques – PHI

REFERENCES

1. AK Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Company, 2004.
2 David A. Bell, Electronic Instrumentation and Measurements, Oxford Universit Press, 2nd Edition
3. Electronic Meeasurements& Instrumentations by K. Lal Kishore, PearsonEducation 2005.

L	T	P	Cr.
-	-	2	1

B.Tech. (V Sem.) **17EC68 - DIGITAL COMMUNICATIONS LAB**

Pre-Requisites: Analog Communications, Signals and Systems

Course Educational Objective: This Course provides practical exposure on different aspects of digital communications. It demonstrates the importance of different modulation techniques in digital communication systems. It also gives the knowledge about different encoding and decoding techniques used in digital communication systems.

Course Outcomes (COs): At the end of the course, student will be able to

CO1: **Demonstrate** time division multiplexing and demultiplexing process using PAM signals.
CO2: **Analyze** different pulse digital modulation techniques.
CO3: **Design** and implement different digital modulation techniques and interpret the modulated and demodulated waveforms.
CO4: **Identify** and describe various encoding and decoding techniques.

LIST OF EXPERIMENTS (Minimum 12 Experiments to be Conducted)

1. Time Division Multiplexing.
2. Pulse Code Modulation.
3. Differential Pulse Code Modulation and Demodulation.
4. Delta Modulation.
5. Adaptive Delta Modulation and Demodulation.
6. Amplitude Shift Keying Modulation and Demodulation.
7. Frequency Shift Keying Modulation and Demodulation.
8. Phase Shift Keying Modulation and Demodulation.
9. Differential Phase Shift Keying Modulation and Demodulation.
10. Linear Block Code- Encoder and Decoder.
11. Binary Cyclic Code- Encoder and Decoder.
12. Simulation of different Line Coding Schemes using MATLAB.
13. Simulation of ASK Modulation and Demodulation using MATLAB.
14. Simulation of FSK Modulation and Demodulation using MATLAB.
15. Simulation of PSK Modulation and Demodulation using MATLAB.

L	T	P	Cr.
-	-	2	1

B.Tech. (V Sem.) **17EC69 - VLSI DESIGN LAB**

COURSE OBJECTIVE: The course explores the design aspects of various combinational and sequential circuits used in VLSI Design. This course also develops the knowledge in VLSI Front End Design Programs Using CPLD/FPGA boards/ CAD tools and Back End Designs using Cadence/Mentor Graphics/ Equivalent CAD tools.

COURSE OUTCOMES: At the end of the course, student will be able to

CO1: Understand the practical aspects of various digital circuit designs.

CO2: Create Logic gates using Static CMOS, NMOS logic from schematic to layout

CO3: Apply various Cadence/Mentor Graphics/ Equivalent CAD tools in VLSI design.

LIST OF EXPERIMENTS

Part-1: VLSI Front End Design programs:

Programs can be done by using any complier. Implementing the below design on Xilinx/Altera/cypress/equivalent based FPGA/CPLD boards.

1. Design and simulation of carry-look- ahead adder.
2. Design of 4x4 Array Multiplier.
3. Design of a 4-bit ALU.
4. Design of Zero /one Detector.
5. Design of flip flops: SR, D, JK, T.
6. Design of 4- bit Binary, BCD counters (synchronous /asynchronous rest).
7. Design of N- bit register of SISO, SIPO, PISO and PIPO.

PART-2: VLSI BACK END DESIGN PROGRAMS:

Design of the following CMOS digital circuits and verification of layouts (DRC, LVS) using Cadence/Mentor Graphics/ synopsys/ Equivalent CAD tools

1. NMOS Inverter.
2. NMOS AND using Pass Transistor.
3. CMOS Inverter
4. CMOS NOR gate.
5. CMOS NAND gate.
6. CMOS XOR using Transmission gates.
7. CMOS Adder.

Note: Minimum of 6 programs from part-1 and 6 designs from part-2 are to be conducted

B.Tech. (V Sem.)	17PD05 - EMPLOYABILITY ENHANCEMENT SKILLS - I	L	T	P	Cr.
		1	-	-	0

Prerequisite: NIL

Course Educational Objective (CEO): This course will make students proficient in Quantitative techniques, language & communication skills to qualify in placement tests, ,demonstrate industry-readiness skills by applying concepts and tools that will serve as building blocks for analytical thinking and professional development.

Course Outcomes (COs): After the completion of this course, student will be able to:

CO1: Apply Quantitative techniques and logical thinking to qualify in recruitment tests and other professional tasks.

CO2: Communicate effectively in various professional and social contexts.

CO3: Apply Verbal skills effectively in Job Interviews as well other professional contexts.

CO4: Demonstrate various principles involved in Quantitative problem solving, thereby reducing the time taken for performing job functions.

CO5: Practice lifelong learning through personal effectiveness as well as leadership.

UNIT – I

Quantitative Aptitude: Numbers, L.C.M & H.C.Fof numbers, Decimal Fractions,Simplification, Square root & cube root-Practice tests.

Verbal Ability: Introduction to Vocabulary-Root words (Prefixes, Suffixes) - Practice tests

UNIT – II

Quantitative Aptitude: Averages, Problems on Ages, Problems on Numbers, Surds and Indices- Practice tests.

Verbal Ability: Advanced vocabulary- Model tests for GRE/TOEFL/IELTS

UNIT – III

Quantitative Aptitude: Percentages, Profit and Loss- Practice tests

Verbal Ability: Synonyms & Antonyms, Idiomatic expressions-Practice tests

UNIT – IV

Quantitative Aptitude: Ratio And Proportion, Partnership, Chain rule- Practice tests

Verbal Ability: Words often confused & misused, One-word substitutes & Flash card activity-Practice tests

UNIT – V

Quantitative Aptitude: Number Series, Letter Series, Blood Relations, Coding and Decoding, Direction sense test- Practice tests

Verbal Ability: Phrasal verbs, Word analogies, Reading Comprehension-Practice tests

TEXT BOOKS

1. R.S.AGGARWAL, *Objective Arithmetic*, S. CHAND Publishers.
2. R.S.AGGARWAL, *Verbal & Non-Verbal Reasoning*, S. CHAND Publishers
3. Objective English. Edgar Thorpe, Pearson Education, New Delhi.2009
4. Sanjay kumar, PushpLata: Communication skills. Oxford, Delhi, 2012

REFERENCES

1. Meenakshi Raman, Sangeetha: Technical Communication, Oxford University Press, 2008
2. Baron's Guide on GRE
3. Dinesh Khattar, *The Pearson Guide to Quantitative Aptitude*, Pearson Education
4. M. Tyra, *Magical Book on Quicker Maths*, BSC Publishers
5. Quantitative Aptitude by Arun Sharma
6. Vocabulary Builder for Students of Engineering and Technology (A self – study manual for vocabulary Enhancement) Y.Saloman Raju, Maruthi Publishers

B.Tech. (VI Sem.)	17EC20 - LINEAR CONTROL SYSTEMS	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Signals and Systems, Electrical Circuits and Networks.

Course Educational Objective: This course provides mathematical models for representing different control systems and various steps in deriving transfer function. Various techniques for time and frequency domain analysis will also be learnt. Verifying for stability of systems using frequency domain analysis will also be studied. The concept of state variables for the analysis of continuous system will be introduced.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the basic concepts of control systems.

CO2: Applythe block diagram and signal flow graph methods for various systems to obtain its transfer function.

CO3: Analyze the stability of the system by using time domain techniques.

CO4: Evaluate the stability of the system by using frequency domain techniques.

CO5: Construct thestate-space model totesttheperformanceofLTIsystems.

UNIT-I:

Fundamentals of Control Systems: Definition of System, Control System, Different examples of Control Systems, Classification of Control Systems, Open Loop and Closed loop Control System and their differences, Effects of feedback.

Representation of Control systems: Transfer function, Block diagram algebra, Reduction of Block diagrams, Signal flow graphs, Reduction of Signal flow graph using Mason's gain formula.

UNIT-II:

Mathematical Models: Translational and Rotational Mechanical systems, Differential equations, Analogous of Mechanical System to Electrical System using Force (Torque)-Voltage, Force (Torque)-Current, Armature and Field Controlled DC Motor, Synchro transmitter and receiver.

Time Response Analysis: Standard test signals, Time response of first order systems, Transient response of second order systems, Characteristic Equation, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of P, PI, PD and PID controllers.

UNIT-III:

Stability in Time domain: Conditions for Stability of a system, Routh's Hurwitz stability criterion, Qualitative stability and Conditional Stability, Limitations of Routh's Hurwitz stability, Root locus concept- construction of root loci, Effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT-IV:

Frequency domain Analysis: Frequency Domain Specifications, Bode plot, Determination of stability from Bode plot.

Nyquist Plots: Polar plots for different transfer functions, Principle of argument, Nyqusit contour, Procedure to plot the Nyquist Plots from the transfer function, Determination of stability from Polar plots and Nyquist Plots.

Compensators: Lead, Lag, Lead-Lag Compensators and their transfer functions.

UNIT-V:

State Space Analysis of Continuous Systems: Concepts of state, State variables and state model, Derivation of state models from transfer function, State space representation using phase variables, Canonical variables, Derivation of transfer function from state model, Diagonalization, Solution of state equations, State Transition Matrix and it's Properties, Computation of state transition matrix using Laplace transformation method, Concepts of Controllability and Observability.

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, "*Control Systems Engineering*", New Age International (P) Limited Publishers,4th edition.
2. Benjamin C. Kuo , "*Automatic Control Systems*" John Wiley and son's ,8th edition, 2003

REFERENCES:

1. Katsuhiko Ogata, "*Modern Control Engineering*", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Norman S. Nise, "*Control Systems Engineering"*, 4th Edition, John Wiley, New Delhi.
3. A. NagoorKani, "*Control Systems" RBA publications,* 2nd edition, 2006.

B.Tech. (VI Sem.)	17CI07 - OOPS THROUGH JAVA	L	T	P	Cr.
		3	-	-	3

Pre-requisites: C, C++.

Course Educational Objective: Concentrates on the methodological and technical aspects of software design and Programming based on OOP. Acquire the basic knowledge and skills necessary to implement object-oriented Programming techniques in software development through JAVA. Know about the importance of GUI based applications and the development of those Applications through JAVA. Get sufficient knowledge to enter the job market related to Web development.

Course Outcomes: At the end of the course, the student will be able to:
CO1: Identify Object Oriented concepts through constructs of JAVA.
CO2: Analyze the role of Inheritance, Polymorphism and implement Packages, Interfaces in Program design using JAVA.
CO3: Explore Exception handling and Multi-threading concepts in program design using JAVA.
CO4: Develop GUI based applications using Applet class and explore the concept of Event Handling using JAVA.
CO5: Design some examples of GUI based applications using AWT controls and Swings.

UNIT – I
Introduction: Drawbacks of POP, Object Oriented paradigm, OOP concepts.
Java Language: History of Java, Java Buzzwords, The Byte code, Simple types, Arrays, Type conversion and casting, simple java programs.
Introducing classes: Class fundamentals, declaring objects, access control and recursion, Constructors, garbage collection, Simple example programs of String and StringBuffer classes, Wrapper classes.

UNIT – II
Inheritance &Polymorphism: Inheritance basics, using super keyword, multilevel hierarchy, Method overloading, Method overriding, Dynamic method dispatch, abstract class, Object class and final keyword.
Packages: Defining a package, Accessing a Package, Understanding CLASSPATH, importing packages, exploring java.util package (StringTokenizer, date classes).
Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Differences between classes and interfaces.

UNIT – III
Exception handling:Exception handling fundamentals, exception types, usage of try& catch, throw, throws and finally, Java Built-in Exceptions.
Multithreading: Differences between multi-threading and multitasking, java thread model, Creating thread, multiple threads and synchronizing threads.

UNIT – IV
Applet Class: Concepts of Applets, differences between applets and applications, applet architecture, skeleton, creating applets, passing parameters to applets, working with Graphicsclass.
Event Handling: Events handling mechanisms, Events, Event sources, Event classes, Event Listeners interfaces, Delegation event model, handling mouse and keyboard events, Adapterclasses, Inner classes.

UNIT – V

AWT controls: label, button, scrollbars, text components, check box, check box groups, Choices controls, lists, scrollbar, text field, layout managers – border, grid, flow.

Introducing Swing:– Introduction, key features of swings, limitations of AWT, components &containers, swing packages, creating swing applet- JApplet class, JComponents- Labels, text fields, buttons – The JButton class, Tabbed Panes, Scroll Panes, Tables.

TEXT BOOKS

Herbert Schildt, "Java: The complete reference", TMH Publications, 7th edition, 2006.

REFERENCES

1. Dr.R.NageswaraRao,"Core JAVA: An Integrated Approach", Dreamtech Press, 1st Edition, 2008.
2. E. Balaguruswamy, "Programming with JAVA", TMH Publications, 2ndEdition, 2000.
3. Patrick Niemeyer & Jonathan Knudsen, "Learning Java", O'REILLY Publications, 3rd Edition, 2005.
4. Benjamin J Evans & David Flanagan,"Java–in a Nutshell – A desktop quick reference", O'REILLY Publications, 6th Edition, 2014.
5. David Flanagan, "Java Examples In a nutshell – A Tutorial companion to java in a nutshell", O'REILLY Publications, 3rd Edition, 2004.

B.Tech. (VI Sem.) **17EC21 - ANTENNA AND WAVE PROPAGATION**

L	T	P	Cr.
2	2	-	3

Pre-requisites: EM Fields and Waves, Transmission Lines and wave guides.

Course Educational Objective: This course provides the knowledge on Antennas and Radiation fundamentals. The course will expose different types of Antennas and their applications. The course also gives the complete information regarding Propagation of Radio wave in atmosphere.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the various antenna properties and radiation mechanism.

CO2: Analyze and synthesize various Antenna Arrays.

CO3: Design different types of High frequency Antennas.

CO4: Evaluate various antenna parameters by using different methods.

CO5: Apply wave propagation mechanism for communication purpose

UNIT-I

Radiation Fundamentals:

Definition and function of Antenna, Radiation Mechanism, Potential functions-heuristic approach, Maxwell's equation approach, Potential functions for sinusoidal oscillations, Analysis of Radiation fields of a Alternating current element , Power radiated by current element, Radiation resistance of current element, Radiation from quarter wave Monopole and half wave dipole, Radiation pattern expressions of Center-fed vertical Dipole, Center-fed Horizontal Dipole.

Antenna Fundamentals: Introduction to Isotropic Radiators, Directional Antennas, Antenna Parameters**:** Radiation intensity, Radiation Pattern, Directive gain, Directivity, Radiation efficiency, Power gain, Beam Width, Beam area, effective aperture, effective length, Band Width, Relation between gain, effective length and radiation resistance, Network Theorems and their application to Antennas.

UNIT-II

Antenna Array Analysis: Various forms of Antenna Arrays, Linear Array of Two Point Sources and N-Point Sources, Expression for electric field from two, three and N element arrays, Broad-side array and End-Fire array, Binomial array, Patterns of Array of Non Isotropic Radiators, Method of pattern multiplication, Methods of Excitation of Antennas.

Array Synthesis: Definition of Synthesis, Different Synthesis Methods**:** Schelnuoff Polynomial Method, Fourier Transform Method, Woodward-Lawson Method, Dolph- Chebyshev Method.

UNIT-III

HF, VHF and UHF Antennas: Resonant Antennas, Non Resonant Antennas, Loop Antenna, Helical Antenna, Travelling wave antennas – V Antenna, Inverted Antenna, Rhombic Antenna, Broadband Antennas-Folded Dipole, Yagi-Uda Antenna, Log-Periodic Antenna.

UNIT-IV

Microwave Antennas: Horn Antenna, Reflector Antennas-Corner Reflector, Parabolic Reflector Antennas, Feed System , Lens Antenna

Antenna Measurements: Measurement of different Antenna parameters- Directional pattern, Radiation resistance, Gain (Two Antenna, Three Antenna Methods), Directivity, Beam width, SLR, Polarization, Impedance, Radiation Efficiency, Aperture Efficiency.

UNIT-V

Wave Propagation: Frequency ranges and types of propagations

Ground Wave Propagation: Characteristics, Parameters, Wave Tilt

Sky Wave Propagation: Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF & Skip Distance – Calculations for flat and spherical earth cases, Optimum Frequency, LUHF, Virtual Height, Ionospheric Abnormalities, Ionospheric Absorption.

Space Wave Propagation: Fundamental Equation for free space Propagation, Basic Transmission Loss Calculations, Space Wave Propagation Mechanism, LOS and Radio Horizon.

Tropospheric Wave Propagation: Radius of Curvature of path, Effective Earth's Radius, Effect of Earth's Curvature, Field Strength Calculations, Duct Propagation, Tropospheric Scattering.

TEXT BOOKS

1. Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & sons Publishers,2nd Edition.
2. K.D. Prasad, Antennas and Wave Propagation, Satya Prakashan Publishers, New Delhi.

REFERENCES

1. G.S.N Raju, "Antennas and Wave Propagation", Pearson Education Publishers.
2. Jordan and Balmain, Electromagnetic fields and Radiating systems, Pearson Education Publishers.
3. John D. Kraus, "Antennas and Wave Propagation", TMH Publishers
4. U.A.Bakshi, A.V.Bakshi, K.A.Bakshi, "Antennas &Wave Propagation", Technical Publications.

B.Tech. (VI Sem.)	17EC22 - MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Digital Circuits, Computer organization

Course Educational Objective : In this course student will learn about the Architecture of 8086 Microprocessor and 8051 Microcontroller and their Assembly Language Programming, interfacing Memory and Various Peripherals with 8086 Microprocessor/8051 Microcontroller and concepts of Interrupts and Serial Communication in reference to 8086

Course Outcomes (COs): At the end of the course, students will be able to

CO1:	**Understand** the architecture and operation of 8086 microprocessor & 8051 microcontroller
CO2:	**Apply** the instructions of 8086/8051 for various applications.
CO3:	**Analyze** the operation of peripherals and devices for different applications.
CO4:	**Design** a system by interfacing memory, peripherals and I/O devices to 8086/8051

UNIT – I

Microprocessor Architecture: Introduction to Microprocessors-Purpose of a Microprocessor, different types of Microprocessors, their features and their comparison; 8086 Microprocessor-Architecture , Special functions of General purpose registers, 8086 flag register and function of 8086 Flags, Addressing modes of 8086.

Instruction Set: Instruction set of 8086, Assembly language programs involving logical, Branch and Call instructions, Sorting, Evaluation of Arithmetic Expressions, String manipulation, Assembler directives, simple programs, procedures and macros.

UNIT – II

8086 Memory and I/O Interfacing: Pin diagram of 8086, Minimum mode and maximum mode of operation, Timing diagram, Memory (Static RAM & EPROM) and I/O interfacing to 8086. Interrupt structure of 8086, Interrupt Vector table, Interrupt service routines.

UNIT – III

Peripherals and Devices: DMA Controller 8237, Interrupt Controller 8259 and Cascading, USART 8251 8255 PPI – various modes of operation, Keyboard, D/A and A/D converter interfacing.

UNIT – IV

Microcontroller: 8051 Microcontroller Architecture, Pin Diagram, Addressing modes, Instruction Set and Programs, 8051 Memory and I/O interfacing .

UNIT – V

8051 Interfacing: Modes of timer operation, Serial port operation, Interrupt structure of 8051, Interfacing of Seven segment Displays, Stepper Motor and Serial/Parallel Printer

TEXT BOOKS

1. Douglas V. Hall, "Micro Processors & Interfacing", TMH, 2007.
2. A. K. Ray and K.M. Bhurchandi, Advanced Microprocessor And Peripherals,2nd Edition TMH Publishers.
3. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. Mckinlay "Microcontrollers and Embedded System", Pearson Education Publishers, 2nd Edition

REFERENCES

1. Raj Kamal, Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education Publishers.
2. J. K. Uffenbeck, "The 8088 and 8086 Micro Processors", PHI, 4th Edition, 2003.
3. Ajay Deshmukh, "Micro Controllers-Theory and Applications", Tata McGraw Hill Publishers.
4. Kenneth J. Ayala, "The 8051 Micro Controller", Cengage Learning Publishers, 3rd Edition, 2000.

B.Tech. (VI Sem.)	17EC23 - NANO ELECTRONICS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Digital electronic circuits, VLSI design

Course Educational Objective: This course provides the knowledge on the present state of the art in the areas of semiconductor devices and materials technology to enable the Nanoelectronics. Eventually, it affords the Impact of Nano electronics onto the information and communication technology.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the integration of various fabrication techniques and logic devices.

CO2: Analyze Carbon Nano structures for Nanoelectronics

CO3: Apply the knowledge of Nanoelectronics for memory devices.

CO4: Design Nanoelectronicsdevices.

UNIT-I

Technology and Analysis: Thin Film Deposition Methods, Lithography, Material Removing Technologies, Etching and Chemical, Mechanical Processing, Optical microscopes for Nano technology, Scanning Probe Techniques.

UNIT-II

Logic Devices: Limitations of the Minimum Applicable Channel Length, Low-Temperature Behavior, High-K Materials for CMOS gate oxide applications, Silicon MOSFETS, Evaluation and Future Prospects, Super Conductor Digital Electronics, Carbon Nano Tubes for Data Processing.

UNIT-III

Carbon Nano Structures: Carbon Clusters, Carbon Nano tubes, Fabrication, Electrical, Mechanical and Vibrational Properties, Applications of Carbon Nano Tubes.

UNIT-IV

Random access memories and mass storage devices: High Permittivity Materials for DRAMs, Ferro Electric Random Access Memories, Magneto-Resistive RAM, Hard Disk Drives, Magneto Optical Disks

UNIT-V

Data transmission, Interfaces and Displays: Photonic Networks, Microwave Communication Systems, Liquid Crystal Displays, Organic Light Emitting Diodes.

TEXT BOOKS

1. WR Fahrner, Nano Technology and Nano Electronics – Materials, devices and measurement Techniques, Springer Publishers, 2005.
2. Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press.

REFERENCES

1. Charles Poole, "Introduction to Nano Technology", Wiley Interscience, May 2003
2. Quantum Transport: Atom to Transistor, S. Datta, Cambridge University Press, 2005, ISBN No. 0-521-63145-9.
3. M. Meyyappan, Carbon Nano tubes: Science and applications, CRC Press.

B.Tech. (VI Sem.)	17EC24 - LOW POWER VLSI DESIGN	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Digital Electronic Circuits, Digital System design and VLSI Design.

Course Educational Objectives: This course provides knowledge on fundamentals of low power VLSI design, low power design approaches, and low power subsystems designs.

Course Outcomes (COs): At the end of this course, student will be able to

CO1: Understand the Fundamentals of Low Power VLSI Design.
CO2: Apply Low-Power Design Approaches for IC designs.
CO3: AnalyzeLow-Voltage Low-Power Memories.
CO4: Design Low-Voltage Low-Power Adders and Multipliers.

UNIT-I

Fundamentals of Low Power CMOS VLSI Design: Introduction, Sources of Power Dissipation, Static Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitch Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering, Body effect, Gate-induced Drain Leakage, Active power dissipation.

UNIT-II

Circuit techniques for Low-Power Reduction: Concepts of leakage power, Circuit techniques for Leakage power reduction-Standby leakage control, Muli-V_{th} technique, Supply voltage scaling, VTMOS circuits, DTMOS circuits, Dynamic-V_{th} technique

UNIT-III

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Select Adders, Carry Save Adders, Performance evaluation of various adder architectures.

UNIT-IV

Low-Voltage Low-Power Multipliers: Introduction, Review of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT-V

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOK

1. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo and Kaushik Roy, Mc Graw Hill Education, 2016.

REFERENCES

1. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.
2. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press, 2002.

B.Tech. (VI Sem.)	17EC25 - CELLULAR AND MOBILE COMMUNICATIONS	L	T	P	Cr.
		3	-	-	3

Pre-Requisites: Radio communication concepts, Fundamentals of antennas.

Course Educational Objective: This course provides the knowledge on basic operation of cellular systems, various techniques to improve the capacity of a cellular system, types of fading and its effects on the radio signal. This course will give an idea about various methods to reduce co-channel and adjacent channel interference. It also provides brief knowledge of Hand-off mechanism, multiple access techniques and digital cellular systems.

Course Outcomes (COs): At the end of the course, student will be able to

CO1	**Understand** the basic concepts of cellular systems, interference, Handoff mechanism, frequency management and channel assignment.
CO2	**Apply** various multiple access techniques to digital cellular systems
CO3	**Evaluate** different types of interferences in cellular systems.
CO4	**Analyze** the radio propagation losses at different cell site and mobile antennas

UNIT – I

Introduction to Cellular Systems: Basic cellular system, Operation of cellular systems-How a cellular telephone call is made, Operational channels, Performance criteria, Uniqueness of mobile radio environment, concept of Digital cellular system.

Elements of Cellular Systems Design and Capacity: Hexagonal shaped cells, Frequency Reuse, Frequency Reuse distance, Concept of frequency Reuse channels, Co-channel Interference Reduction Factor, Desired C/I from a normal case in a omnidirectional Antenna system, Cell splitting, Sectoring, Microcell zone concept.

UNIT – II

Mobile Radio Propagation: Basics of mobile radio propagation mechanisms, Free space propagation, Link budget design, Propagation models, small-scale multipath propagation, factors influencing fading, Types of small scale fading.

Cell Site Antennas And Mobile Antennas: Cell site antenna height, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, Minimum separation of cell site receiving antennas, Mobile high gain antennas, Concept of sum and difference pattern.

UNIT – III

Interference: Introduction to Co-Channel Interference, procedure to find nearest neighbors of a particular cell, real time Co-Channel interference, Determination of Co-Channel interference area, Design of Antenna system, impact on co-channel interference by lowering the antenna height, non-co-channel interference-different types.

UNIT – IV

Frequency Management and Channel Assignment: Numbering and grouping, setup channels, access channels and paging channels, channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

Handoffs and Dropped Calls: Types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff, Intersystem handoff, dropped call rates and their evaluation.

UNIT – V

Multiple Access Techniques: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access.

Digital Cellular Systems: 2G Systems-Global System for Mobile,**3G Systems**-Wideband CDMA, CDMA 2000 ,introduction to **4G & 5G technologies**.

TEXT BOOKS

1. William C.Y. Lee,"Mobile Cellular Telecommunications", Tata McGraw Hill, 2nd Edition, 2006.
2. Gottapu Sasibhushana Rao, "MobileCellular Communication", Pearson Education, 1st Edition, 2013.

REFERENCE BOOKS

1. Theodore S. Rappaport ,"Wireless Communications", Pearson Education, 2nd Edition, 2002.
2. Andrea Goldsmith, "Wireless communications", Cambridge University press, 2005.

B.Tech. (VI Sem.)	17EC26 - TRANSFORM TECHNIQUES	L	T	P	Cr.
		3	-	-	3

Pre-Requisites: Signals & Systems, Digital Signal processing

Course Educational Objective: This course introduces the underlying concepts of transforms meant for representing and analyzing signals. It also provides knowledge about various classes of 2D transforms. It presents a precise discussion on the limitations of global transforms and the remedial measures to overcome them. The course specifiesthe role of transforms in solving numerous real time problems.

Course Outcomes (COs): At the end of the course, student will be able to

CO1: Understand the fundamental concepts of various transforms and significance of time frequency analysis
CO2: Analyze numerous 2 D Transforms based on their properties
CO3: Evaluate the role of scaling function in the representation of signals
CO4: Apply the transforms in solving real time problems

UNIT – I

Review of Transforms: Need for Transforms, Concepts of Unitary Matrices, Fundamental Properties of Unitary Transforms, 1D – Transforms: Discrete Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform, HaarTrasnform , Slant Transform, KL Transform.

UNIT – II

2D Transforms and properties: Examples of 2D Functions, 2D DFT and Properties, Inverse 2D DFT,2D DCT, Haar Transform,Walsh &Hadamard Transform.

UNIT – III

Short time Fourier Transform: Time-Frequency limitations, Tiling of Time-Frequency Plane for STFT, Short Time Fourier Transform (STFT) Analysis, Limitations of STFT.

UNIT – IV

Multi Resolution Analysis: Need for Wavelets, Concept of scaling and its relation frequency, series expansion, scaling functions, Wavelet functions, Wavelet Transforms in one dimension: Wavelet series expansion, Discrete Wavelet transform, Continuous Wavelet transform.

UNIT – V

Applications of Transforms: Signal Denoising, Sub Band Coding of Speech and Music, Signal Compression - Use of DCT, DWT,KLT, 2-D DWT

TEXT BOOK

1. Rafael C. Gonzalez , Richard E. Woods, " *Digital Image Processing*", Pearson Education, 2008
2. Jaideva C Goswami, Andrew K Chan,*" Fundamentals of Wavelets- Theory, Algorithms and Applications",* John Wiley & Sons, Inc, Singapore, 1999.

REFERENCES

1. Anil K Jain, "*Fundamentals of Digital Image Processing*", PHI Learning Private Limited,2010
2. Rafael C. Gonzalez , Richard E. Woods, " *Digital Image Processing*", Addison Wesley, 1992

L	T	P	Cr.
-	-	2	1

B.Tech. (VI Sem.) **17FE61 - PRESENTATION SKILLS LAB**

Pre-requisites: Students should have fundamental knowledge in making Conversations in English and be with readiness to speak

Course Educational Objective: To help students make oral presentations, power point presentations, participate in group discussions and Write project/research reports/technical reports/ formal letters by gathering information and organizing ideas relevantly and coherently.

Course Outcomes: At the end of the course, the student will be able to
CO1: Make power point presentations and oral presentations.
CO2: Use standard vocabulary contextually.
CO3: Manage skilfully through group discussions.
CO4: Negotiate skilfully for better placement.

Syllabus: English Communication Skills Lab (ELCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self- study by learners.
- **Interactive Communication Skills (ICS) Lab.** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo – audio & video system and camcorder etc.

Exercise – I
CALL Lab:
Understand: synonyms and antonyms, one-word substitutes, analogy, idioms and phrases.
ICS Lab:
Practice: Ice-Breaking Activity and JAM Session – Introducing Oneself – Extempore - Public Speeches.

Exercise – II
CALL Lab:
Understand: Features of Good Conversation – Strategies for Effective Communication.
ICS Lab: Group Discussion

Exercise – III
CALL Lab:
Understand: Data collection – Organizing data - Making Poster – Making slides.
ICS Lab:
Practice: Poster Presentation – Power Point Presentations.

Exercise – IV
CALL Lab:
Understand: Types of Résumé – Letter Writing.
ICS Lab:
Practice: Writing Résumé & Letters

Exercise – V
CALL Lab:
Understand: Reading comprehension – Listening Comprehension – scanning, skimming, reading between lines and critical reading.

ICS Lab:
Practice: Reading comprehension - Listening Comprehension – scanning, skimming, reading between lines and critical reading.

Exercise - VI
CALL Lab:
Understand: Interview Skills
ICS Lab:
Practice: Mock Interviews

Lab Manual:
Board of Editors, "ELCS Lab Manual – A Workbook of CALL and ICS Lab Activities", Orient Black Swan Pvt. Ltd., Hyderabad, 2016.

SUGGESTED SOFTWARE:
1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley, USA, 2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company, USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi, 2008

B.Tech. (VI Sem.)	17EC91 - TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS (Add on course – II)	L	T	P	Cr.
		3	-	-	3

Pre-requisites:

Course Educational Objective: This course provide the knowledge on basics of telecommunication switching system, networks, traffic engineering and also fundamentals of data communication networks.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Remember fundamental concepts of switching systems, network parameters in telecommunications.

CO2: Understand various network architectures, switching techniques and higher data rates telecommunication techniques.

CO3: Apply numerous telephone network and load parameters to maintain smooth traffic in networks.

CO4: Analyze the performance of different switching systems, data communication networks and higher data rates.

UNIT-I

Introduction: Evaluation of Telecommunication, Basics of switching Systems, Switching system parameters, switching system components.

Cross bar Switching: principal of Common Control, touch tone dial telephone, principles of cross bar switching, cross bar switch configuration, cross point technology, cross bar exchange organization.

Electronic Space Division Switching: Stored program control, Centralized SPC, Distributed SPC, Enhanced services, Two stage networks, Three stage Networks.

UNIT-II

Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching.

UNIT-III

Telephone Networks: Subscriber Loop System, Switching hierarchy and Routing, Transmission Plan, Numbering Plan, Charging Plan, Signaling Techniques, In Channel Signaling, Common Channel Signaling.

Traffic Engineering: Network Traffic Load and parameters, Grade of Service and blocking probability.

UNIT-IV

Data Communication Networks: Introduction, network architecture, network topologies, layered network architecture-OSI reference model, protocols, data communications hardware, data communication circuits. Circuit Switching, packet switching and virtual circuit switching concept, Types of networks, Repeaters, Bridges, Routers and gate ways.

Integrated Services Digital Network- ISDN Protocol Architecture, Transmission Channels, User Network Interfaces, Signaling, Numbering and Addressing.

UNIT-V

Digital Subscriber Line: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS, SONET- Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS-I, Virtual Tributaries.

TEXT BOOKS

1. Viswanathan. T, Telecommunication Switching System and Networks, Prentice Hall of India Ltd., 1994.
2. Behrouz. A. Forouzan, Data Communication and Networking, Fourth Edition, Tata McGraw-Hill, New Delhi, 2006.

REFERENCES

1. J. E. Flood, Telecommunication Switching Traffic and Networks, Pearson Education.
2. L. S. Lawton, Integrated Digital Networks, Galgotta Publication Pvt., Ltd., New Delhi, 1996.
3. Syed R. Ali, Digital Switching Systems, McGraw-Hill Inc., New York, 1998

B.Tech. (VI Sem.) **17CI65 - OOPS THROUGH JAVA LAB**

L	T	P	Cr.
-	-	2	1

Pre-requisites **:** C, C++.

Course Educational Objective: Concentrates on the methodological and technical aspects of software design andProgramming based on OOP.Acquire the basic knowledge and skills necessary to implement object-orientedprogramming techniques in software development through JAVA.Know about the importance of GUI based applications and the development of applications through JAVA.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Implement and Test the concepts of OOP in program design with a few example exercises.

CO2: Implement and Test the performance of Exception handling, Multithreading concepts with a few example exercises.

CO3: Implement and Test the performance of GUI based applications using AWT, Swings.

I. Exercise programs on basic control structures & loops:

a) Write a java program to generate Fibonacci series.
b) Write a java program to check whether given number is prime or not?
c) Write a java program to find out area of a circle.
d) Write a java program to reverse the given number.
e) Write a java program to find the sum of the numbers by using Command line arguments.
f) Write a java program to find the roots of a quadratic equation.

II. Exercise programs on Recursion in java:

a) Write a java program to find the factorial of a given number using recursion.
b) Write a java program to find sum of 'n' numbers using Recursion.

III. Exercise programs on Arrays in java:

a) Write a java program to find min and max number of given Array.
b) Write a java program to perform matrix Multiplication.
c) Write a java program to search an element by using linear search.
d) Write a java program by using Bubble sort.

IV.Exercise programs on Constructors & Method overloading

a) Write a java program to implement Over Loading?
b) Write a java program using Constructors.
c) Write a java program to implement constructor overloading.

V. Exercise programs on String &StringBuffer classes:

a) Write a java program using StringBuffer class methods?
b) Write a java program to check whether the given string is palindrome (or) not?
c) Write a java program to sort the Strings in ascending order.

VI. Exercise programs on Inheritance, super & final keywords:

a) Write a java program to implement stack ADT?
b) Write a java program using Inheritance.
c) Write a java program illustrating all three usages of super key word.
d) Write a java program using Abstract class.
e) Write a java program by using final variables and final methods.

VII.Exercise programs on Runtime Polymorphism in java:

a) Write a java program to implement Overriding.
b) Write a java program to implement Dynamic method dispatch.

VII.Exercise programs on packages & interfaces.

a) Write a java program to demonstrate Packages.
b) Write a java program to implement multiple inheritance using interfaces.
c) Write a java program to implement StringTokenizer class.
d) Write a java program to implement the Date class.

VIII. Exercise programs on Exception handling &Multithreading.

a) Write a java program by using Exception handling mechanism.
b) Write a java program to implement chained exception.
c) Write a java program to create Multiple Threads using Thread class.
d) Write a java program to create Multiple Threads using Runnable interface.
e) Write a java program to synchronize Multiple Threads.

IX.Exercise programs on Applets & Event Handling:

a) Write a simple Applet program.
b) Write an applet program using Graphics.
c) Write an applet program to pass parameters to Applet.
d) Write an applet program to display information an applet.
e) Write an applet program to handle Mouse events.
f) Write an applet program using Key events.

X.Exercise programs on AWT Components & Layout Managers.

a) Write a java program by using AWT components.
b) Write a java program to various layout managers (border, flow, and grid).

XI. Exercise programs on Swings:

a) Write a java program by using swing components.
b) Write a java program to by using swing scroll bars.

B.Tech. (VI Sem.)	17EC70 - MICROPROCESSORS AND MICROCONTROLLERS LAB	L	T	P	Cr.
		-	-	2	1

Pre-requisites: Pulse and switching circuits lab

Course Educational Objective: In this course, student will understand working of instructions by practicing programs of 8086 / 8051 and develop applications by interfacing devices.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: **Demonstrate** program proficiency using the various instructions of the 8086 microprocessor / 8051 microcontroller.

CO2: **Apply** different programming techniques like loops, subroutines for various applications.

CO3: **Design** systems for different applications by interfacing external devices.

LIST OF EXPERIMENTS

Part-1: 8086 programs:

1. Program to demonstrate data transfer operation
2. Program to demonstrate arithmetic operation
3. Program to demonstrate logical operation
4. Program to demonstrate shift operation
5. Program to demonstrate string operation
6. Program to demonstrate looping operation
7. Program to demonstrate decision making operations

PART-2: 8051 PROGRAMS:

1. Programs to demonstrate bit-manipulation operations.
2. Programs using Interrupts
3. Programming timer / counter.
4. Programming Serial communication application.
5. Program to demonstrate decision making operations
6. Program to demonstrate looping operations

PART-3: INTERFACING PROGRAMS (using 8086 & 8051 Kits)

8. Interfacing ADC
9. Interfacing DAC .
10. Interfacing stepper motor.
11. Interfacing 7-segment display.
12. Interfacing keyboard.
13. Interfacing serial/parallel Printer.

B.Tech. (VI Sem.)	17PD08 - EMPLOYABILITY ENHANCEMENT SKILLS – II	L	T	P	Cr.
		1	-	-	0

Prerequisite: NIL

Course Educational Objective (CEO): This course will make students proficient in Quantitative techniques, language & communication skills to qualify in placement tests, demonstrate industry-readiness skills by applying concepts and tools that will serve as building blocks for analytical thinking and professional development.

Course Outcomes (COs): After the completion of this course, student will be able to:
CO1: To identify, analyze and apply quantitative techniques related to qualify in Placement tests.
CO2: To effectively utilize verbal ability & communication skills to qualify in Placement tests.
CO3: To effectively communicate in professional as well as social contexts.
CO4: To apply key soft skills effectively in Job Interviews as well in other professional contexts
CO5: Inculcate lifelong learning through personal effectiveness as well as leadership.

UNIT – I:
Verbal Ability: Tenses& Conditional Clauses
Quantitative Aptitude: Alligation or Mixture**,** Simple Interest and Compound Interest

UNIT – II:
Verbal Ability: Sentence Completions
Quantitative Aptitude: Time and work, Pipes and Cistern, Permutations and Combinations, Probability

UNIT – III:
Verbal Ability: Spot the Errors
Quantitative Aptitude: Time and Distance, Problems on trains,Boats and Streams, Races and Games of Skill

UNIT – IV:
Verbal Ability: Jumbled Sentences, Cloze Tests
Quantitative Aptitude: Area, Volume and Surface Areas, Progressions

UNIT – V:
Verbal Ability: Advanced Reading Comprehension
Quantitative Aptitude: Clocks and Calendars, Cubes and Dice

TEXT BOOKS:
1. Objective Arithmetic, S. CHAND Publishers.
2. R.S.AGGARWAL, *Verbal & Non-Verbal Reasoning*, S. CHAND Publishers.
3. Objective English. Edgar Thorpe, Pearson Education, New Delhi.2009.
4. Sanjay Kumar, PushpaLata: Communication skills. Oxford, Delhi, 2012.
5. Vocabulary Builder for Students of Engineering and Technology (A self – study manual for vocabulary Enhancement) Y.Saloman Raju, Maruthi Publishers

REFERENCES:

1. Meenakshi Raman, Sangeetha: Technical Communication, Oxford University Press, 2008
2. Baron's Guide on GRE
3. Dinesh Khattar, *The Pearson Guide to Quantitative Aptitude*, Pearson Education
4. M. Tyra, *Magical Book on Quicker Maths*, BSC Publishers
5. Quantitative Aptitude by Arun Sharma
   Vocabulary Builder for Students of Engineering and Technology (A self – study manual for vocabulary Enhancement) Y.Saloman Raju, Maruthi Publishers

L	T	P	Cr.
2	2	-	3

B.Tech. (VII Sem.) **17EC27 - MICROWAVE ENGINEERING**

Pre-requisites : Electromagnetics, waveguides

Course Educational Objective : This course provides the knowledge on microwave communication in terms of various bands, advantages, applications. The course will give an idea about microwave active and passive devices. The course also gives the complete information regarding microwave bench setup and microwave measurements.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the operation and use of Microwave solid state devices

CO2: Analyze the characteristics of Microwave tubes.

CO3: Apply the properties of S-parameters to waveguide components.

CO4: Evaluate the various microwave parameters using microwave bench setup.

UNIT-I

Introduction, Microwave Spectrum and Bands, Advantages and Applications of Microwaves.
Microwave Tubes: Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications.
Klystron Tubes: Two Cavity Klystrons – Structure, Velocity Modulation Process and Applegate Diagram, Bunching Process– Expressions for o/p Power and Efficiency. Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, o/p Characteristics.

UNIT-II

Helix TWT: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process, Axial Electric Field, Convection Current, Propagation Constants, Gain Considerations.
M-Type Tubes : Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron: Hull Cut-off and Hartee Conditions, Modes of Resonance and PI-Mode Operation, o/p characteristics, Frequency Pulling and Frequency Pushing, Strapping.

UNIT-III

Microwave Solid State Devices: Introduction, Classification, Applications.
Transferred Electron Devices: Introduction, Gunn Diode – Principle, Two Valley Model Theory, RWH Theory, Characteristics, Modes of Operation.
Avalanche Transit Time Devices: Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics, related expressions.

UNIT-IV

Waveguide Components-I: Waveguide Multiport Junctions – E plane and H plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2 Hole, Bethe Hole types. Scattering Matrix– Significance, Formulation and Properties. S Matrix Calculations for E plane and H plane Tees, Magic Tee, Directional Coupler.

UNIT-V

Waveguide Components-II: Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads; Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types; Ferrites– Composition and Characteristics, Faraday Rotation; Ferrite Components – Gyrator, Isolator, Circulator.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Precautions; Measurement of Attenuation, Frequency, VSWR, Cavity Q, Impedance, Power.

TEXT BOOKS

1. Samuel Y. Liao, "Microwave Devices and Circuits", PHI Publishers, 3rd Edition, 2003.
2. David M.Pozar, "Microwave Engineering", John Wiley Publishers,4th Edition.

REFERENCES

1. G. S. N. Raju, "Microwave Engineering", IK International Publishers, New Delhi
2. Robert E. Collin "Foundations for microwave engineering" Tata McGraw Hill,2nd edition
3. M Kulakarni, "Microwave and Radar Engineering", Umesh Publications, New Delhi 5th Edition,
4. Peter A. Rizzi, "Microwave Engineering Passive Circuits", Prentice-Hall Publishers.
5. G. Sasibhushana Rao, "Microwave and Radar Engineering", Pearson Education India.

B.Tech. (VII Sem.)	17EC28 - OPTICAL COMMUNICATIONS	L	T	P	Cr.
		2	2	-	3

Pre-requisites: Electromagnetic Theory,analog communications and digital communications.

Course Educational Objective: This course gives knowledge on optical communication fundamentals, fiber types, and fiber materials. This course also describe about transmission losses in the fiber, optical sources, source to fiber coupling scheme, and optical receivers. This course also provides understanding of digital optical link, analog optical systems, wavelength division multiplexing and optical networks.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: **Remember** the fundamentals of optical fiber communications.

CO2: **Understand** the concepts of optical fiber communication systems, WDM systems, and optical networks.

CO3: **Apply** knowledge onsignaltransmission characteristics of fibers, sources and detectors.

CO4: **Analyze** the optical device characteristics and their signal degradation mechanisms in analog and digital signal transmission.

CO5: **Evaluate** the performance of various optical transmitters, receivers and optical systems

UNIT-I: Overview of Optical Fiber Communications:

The general System, The Evolution Of Fiber Optic Systems, Elements of an Optical Fiber Link, Merits and demerits of Optical Fiber Communications, Applications of optical fiber communications. Basic Optical Laws and Definitions: Refractive index, Refraction, Reflection, Critical Angle and Total internal Reflection. Optical Fiber structure, Step Index Fiber Structure, Graded Index Fiber Structure. Ray Optics Representation, Acceptance Angle, Numerical Aperture, Meridional and Skew Rays. Overview of Modes, Summary of Key Modal Concepts. Single-Mode Fibers, Cutoff Wavelength, Mode-Field Diameter.

UNIT-II: Fiber Materials and Signal Degradation in Optical Fibers:

Fiber Materials, Glass Fibers, Active Glass Fibers, Plastic Optical Fibers. Attenuation, Attenuation Units, Absorption, Scattering Losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides, Information Capacity determination, Group Delay, Material Dispersion, Polarization-Mode Dispersion, Intermodal Distortion, Pulse Broadening in Graded-Index Waveguides, Mode Coupling, Design Optimization Of Single-Mode Fibers, Refractive-Index Profiles.

UNIT-III:

Optical Sources:

Requirement of optical sources, LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation of an LED, LASER Diodes, Laser Diode Modes and Threshold Conditions, Semiconductor Laser Diodes, Fabry Perot Lasers, Distributed Feedback (DFB) Lasers, Laser diode rate equations, External quantum efficiency, and resonant frequencies.

Power Launching and Coupling:

Source to fiber power launching, Source Output Pattern, Power-Coupling Calculation, Lensing Schemes for Coupling improvement, Laser Diode-to-Fiber Coupling.

UNIT-IV: Optical detectors and receivers:

Photo detectors, Physical Principles of Photodiodes, PIN Photo detector, Avalanche Photo diodes, Detector Response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance: Probability of error, The Quantum limit, Analog Receivers.

UNIT-V:

Digital Transmission Systems and measurements:

Point to point links, systems considerations, Link Power budget, Rise time budget, Line coding, NRZ Codes, RZ Codes, Measurement of attenuation and dispersion.

WDM and SONET/SDH:

WDM Features, Operational principles of WDM, Types of WDM, SONET/SDH Networks

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communications, Mc Graw-Hill International edition,4th Edition, 2008.
2. Joseph C. Palais, Fiber Optic Communications, Pearson Education, 4th Edition, 2004.

REFERENCES:

1. John M. Senior, Optical Fiber Communications, PHI, 2nd Edition, 2002.
2. Govind P. Agarwal,Fiber Optic Communication Systems, John Wiley, 3rd Edition, 2004.
3. S. C. Gupta,Text Book on Optical Fiber Communication and its Applications, PHI,2005.

B.Tech. (VII Sem.)	17EC29 - EMBEDDED SYSTEM DESIGN	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Microprocessors and Microcontrollers, Computer Organization.

Course Educational Objective : This course provides the knowledge on typical embedded system design methodologies, characteristics and design metrics, computational models for describing embedded system behavior, standard single purpose processors, various communication protocols and design technology for implementing embedded system.

Course Outcomes (COs): At the end of the course, students will be able to

- **CO1:** Understand different design methodologies for embedded system design
- **CO2:** Design Control unit and data path using computational models
- **CO3:** Describe the basic functionality of several standard single purpose processors commonly found in embedded systems
- **CO4:** Analyze various communication protocols
- **CO5:** Develop embedded system using IC and Design Technology

UNIT - I:

Embedded System Introduction: Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic(RT level), custom single purpose processor design(RT – level), optimizing custom single purpose processors.

UNIT - II:

State Machine and Concurrent Process Models: Introduction, models Vs languages, finite state machines with data path model(FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, Implementation, data flow model, real-time systems.

UNIT - III:

Standard Single-Purpose Processors: Introduction, Timers, Counters, and watchdog timers, UART, LCD Controllers, Stepper Motor Controllers, Analog-to-Digital Converters, Real-Time Clocks, **Memory**: Common memory types, Memory hierarchy and cache, Advanced RAM

UNIT - IV:

Interfacing: Introduction, Communication basics, Microprocessor Interfacing: I/O Addressing, Interrupts, Direct memory access, Arbitration, Multilevel bus architectures, Advanced communication principles, Serial Protocols, Parallel Protocols, Wireless Protocols

UNIT - V:

IC and Design Technology: IC Technology: Full-Custom(VLSI) IC Technology, Semicustom(ASIC) IC Technology, Programmable logic device(PLD) IC technology, Design technology: automation: synthesis, verification: Hardware/Software Co-Simulation, Reuse: Intellectual Property cores, Design Process Models

TEXT BOOKS:

Frank Vahid/Tony Givargis, "Embedded System Design A unified Hardware/Software Introduction" John Wiley &Sons,Inc.

REFERENCES

1. James K Peckol, "Embedded Systems- A Contemporary Design Tool" John Weily, 2008
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Newnes, Elsevier, 2008.

B.Tech. (VII Sem.)	17EC30 - AUTOMOBILE AND CONSUMER ELECTRONICS	L	T	P	Cr.
		3	-	-	3

Pre-requisites : Knowledge on automobile and Consumer ElectronicsDevices

COURSE EDUCATIONAL OBJECTIVES

In this subject student will learn about The Characteristics of Batteries and Lighting system. The Construction and maintenance of starter motor. The Concepts of charging system. The Fundamentals of Automotive Electronics. Application of various sensors and Activators. Operation and types of Loud speakers and Microphones and also different home and office appliances.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Understand the working of loud speakers, microphones, batteries, lights automobile devices and home, electrical office electronic appliances.
CO2	Apply various types of sensors and activators in automobile engine parameters and the regulators concept to real time applications.
CO3	Analyze the automotive electronic devices working principle.
CO4	Create the starting system and charging system.

UNIT – I

BATTERIES AND ACCESSORIES: Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods-Horn, wiper system and trafficator.

UNIT – II

STARTING SYSTEM: Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

CHARGING SYSTEM: Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

UNIT – III

FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS: Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

UNIT-IV

Loudspeakers and Microphones: Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters - Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

Electrical Appliances: Working principle of Inverter, UPS, Electric Cooker, Water heater, Lift, generator, Motor.

Office Appliances: Working principle of Xerox machine, Laser Printer, Scanner, Electronic Voting Machine.

UNIT – V

Optical Recording and Reproduction: Audio Disc – Processing of the Audio signal –read out from the Disc – Reconstruction of the audio signal – Video Disc – Video disc formats- recording systems– Playback Systems, CD player, CD-ROM, Digital Audio tape.

SENSORS AND ACTIVATORS: Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

TEXT BOOKS

1. P. Bali, "Consumer Electronics", Pearson Education, 2005.
2. Young A.P. andGriffiths. L,"Automotive Electrical Equi[ment" New Press&ELBS 1999

REFERENCES

1. Philip Hoff, "Consumer Electronics for Engineers", Cambridge University Press ISBN 9780521582070
2. William B. Riddens "understanding Automotive Electronics", Butter Worth Heinemann Woburn, 5th Edition.

B.Tech. (VII Sem.)	17EC31 - ANALOG VLSI DESIGN	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Electronic devices and circuits, Electronic circuit analysis

Course Educational Objectives: The course offers analog integrated circuits operation, analysis, methodologies, implementation approaches, design skills of integrated circuits and understands the constraints for a practical IC design.

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Remember the operation of MOS devices.

CO2: Understand the working of single stage MOS amplifiers.

CO3: Evaluate the frequency response of MOS amplifiers.

CO4: Analyze the working of differential and Operational amplifiers

UNIT-I

Basic MOS Device Physics: General considerations of MOSFET, MOSFET I/V characteristics, second order effects, MOS device models-lay out, capacitances and small signal model.

UNIT-II

Single-stage amplifiers: Basic concepts, common source stage with resistive and diode connected loads, common source with source degeneration, folded cascade stage, device models.

UNIT-III

Frequency response of amplifiers: General considerations, miller effect, common source stage, source follower, common gate stage, cascade stage, differential pair.

UNIT-IV

Differential Amplifiers: Single ended and differential operation, differential pair-qualitative and quantitative analysis, common mode response, differential pair with MOS loads, Gilbert cell

UNIT-V

Operational Amplifiers: General considerations, performance parameters, one-stage Op-amps, two-stage Op-amps, gain boosting, comparison, input range limitations, slew rate, power supply rejection ,Noise in Op-amp.

TEXT BOOKS

BehzadRazavi: Design-of-Analog-CMOS-Integrated-Circuits McGraw Hill International Edition Electrical Engineering series

REFERENCES

David. A. Johns and ken Martin Analog integrated circuit design, john wiley and sons, 2001

B.Tech. (VII Sem.)	17EC32 - SATELLITE COMMUNICATIONS	L	T	P	Cr.
		3	-	-	3

Pre-Requisites: Microwave frequency bands, Basic concepts related to communication, Multiple access techniques and Digital modulation techniques.

Course Educational Objective: This course provides the technical knowledge of orbital dynamics, launching of satellite in to the orbit, various subsystems used in space segment, uplink and downlink aspects of satellite. This course will also give an idea about different multiple access techniques, design requirements for the selection of earth station and various real time applications.

Course Outcomes (COs): At the end of the course, student will be able to

CO1: **Understand** the basic concepts of satellite communication, laws associated with the motion of a satellite, various subsystems and link design
CO2: **Apply** basic concepts of satellite communication in real time applications
CO3: **Evaluate** the orbital model, parameters and know the process of launching a satellite
CO4: **Analyze** different multiple access methods and types of earth stations

UNIT-I

Introduction and Orbit Dynamics-I : Need of satellite communication, Definition of a satellite and orbit, Frequency allocations for satellite services, General structure of satellite communication system, Different types of orbits, Merits and demerits of satellite communication, Kepler's three laws of planetary motion, Definitions of terms for earth orbiting satellites.

UNIT-II

Orbital Dynamics-II and Launching: Orbital elements, Orbital perturbations-need for station keeping, Non geostationary orbits and geostationary orbits, Orbital effects: Doppler shift, Range variation, solar eclipse and sun transit outage, Look angle determination: elevation angle and azimuth angle calculation, types of launch vehicles: ELV &RLV, launching of geostationary satellites.

UNIT-III

Space Segment and Link Design: Introduction to space segment, Power supply, Attitude and orbital control: spinning satellite stabilization and momentum wheel stabilization, Station keeping, Thermal control, TT&C subsystem, Transponders, Antenna subsystem, Link power budget equation, Satellite uplink and down link design, system noise and noise temperature, C/N and G/T ratio calculations.

UNIT-IV

Satellite Multiple Access : Introduction to multiple access, Single access, Pre-assigned FDMA and demand assigned FDMA,TWT amplifier operation-inter modulation products, FDMA downlink analysis, TDMA Frame structure- Reference bursts-preamble and Postamble, Traffic burst, Carrier recovery, Preassigned and demand assigned TDMA, CDMA introduction: spread spectrum transmission and reception, Related Problems.

Earth Segment: Design requirements for the selection of earth segment, Transmit only earth station, Receive only earth station, Transmit -Receive (T/R) earth station.

UNIT-V

Satellite Applications: GPS (Global Positioning System) architecture and location principle, Direct Broadcast Satellite (DBS/DTH)-Home receiver block (Indoor & Outdoor Unit), VSAT, MSAT, RADARSAT, IRNSS constellation, Further applications.

TEXT BOOKS

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003.
2. Dennis Roddy ,"Satellite communications", Tata McGraw Hills, 4th Edition, 2009.

REFERENCES

1. D.C Agarwal , "Satellite communications", Khanna Publications, 5th Edition,2006.
2. M. Richharia, "Satellite Communications Systems: Design principles", BS Publications, 2nd Edition, 2005.
3. Andrea Goldsmith, "Wireless communications", Cambridge University press, 2005.

L	T	P	Cr.
3	-	-	3

B.Tech. (VII Sem.) **17EC33 - DIGITAL IMAGE PROCESSING**

Pre-requisites: Set Theory, Partial Differential Equations, Digital Signal Processing.

Course Educational Objective: This course provides the fundamental concepts of Image Processing. Image enhancement which is the most prominent preprocessing step will be learnt in both time and spectral domain. The course also gives the basics of color images and their processing. Knowledge about compression as well as segmentation will also be given.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Remember the basic concepts of 2D signal acquisition and human visual system.

CO2: Analyze image enhancement techniques in spatial and frequency domain.

CO3: Evaluate numerous restoration and compression techniques.

CO4: Apply the fundamental concepts of image processing for segmentation.

CO5: Understand the various concepts of color image processing techniques.

UNIT-I

Introduction: Introduction to 2D function, Light, Luminance, Brightness and Contrast, Digital Image, Fundamental Steps and Components of an Image Processing System, Applications of Image Processing, Structure of Human Eye, Image formation in the Eye, Sampling and Quantization, Representation of Digital Images, Spatial and intensity Resolution, Relationship between pixels: Neighborhood, Adjacency, Connectivity, Region, Boundary, Distance Measures.

UNIT-II

Image Enhancement in Spatial Domain: Spatial domain Enhancement, Point processing, Intensity Transformation Functions: Image Negatives, Log Transformation, Power-Law(Gamma) Transformations, Piecewise-Linear Transformation Functions: Contrast Stretching, Gray Level Slicing, Bit Plane Slicing, Histogram Processing: Histogram equalization and Histogram Specification. Smoothing Spatial Filters: linear filters, order-statistic (Nonlinear) filters, Sharpening Spatial Filters: Gradient, Laplacian,

Image Enhancement in Frequency Domain: Filtering in Frequency domain Enhancement, Image Smoothing using Ideal low pass filters, Butterworth low pass filters, Gaussian low pass filters, Sharpening using Ideal high pass filters, Butterworth high pass filters, Gaussian high pass filters, Laplacian in the frequency domain, Unsharp masking, High boost filtering.

UNIT-III

Image Restoration: Image Restoration Degradation model, Noise Models, Restoration in the Presence of Noise: Spatial Filtering, Mean Filters, Least mean square filters, Order-Statistics Filters, Adaptive Filters, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained least squares filtering.

Image Compression: Coding Redundancy, Interpixel and Psychovisual Redundancy, Image Compression Models, Error free compression: Huffman coding, LZW coding, Loss less Predictive Coding, Lossy Compression: Lossy Predictive Coding, Transform coding, JPEG image compression standard.

UNIT-IV

Image Segmentation: Detection of discontinuities, Detection of Isolated Points, Line Detection, Edge Detection, Edge Linking and Boundary Detection: Local Processing, Global Processing via the Hough Transform & Graph-Theoretic Techniques, Thresholding: Basic Global Thresholding, Region based segmentation: Region growing, Region splitting and merging.

UNIT-V

Color Image Processing: Color Fundamentals, Color Models: RGB, CMY, CMYK, and HSI color model, Pseudo color image processing: Intensity slicing, Color transformations,
Full-Color Image Processing: Color transformation, Color slicing, Color compliment, Tone and color corrections, Color Histogram.

TEXT BOOKS

R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Addison Wesley/ Pearson education, 3rd Edition, 2002 **.**

REFERENCES

1. Anil K. Jain, "Fundamentals of Digital Image Processing", PHI Publications.
2. William J Pratt, "Digital Image Processing", John Wiley & Sons
3. Tinku Acharya, Ajoy K Ray, "Image Processing Principles and applications", Wiley-Inter Science
4. S.Jayaraman, E.Esakkirajan, T.Veerakumar, "Digital Image Processing", TMH edition, 2011
5. S Sridhar, "Digital Image Processing", Oxford University press, 2011

B.Tech. (VII Sem.)	17EC34 - MEDICAL ELECTRONICS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Sensors & Signal Conditioning

COURSE EDUCATIONAL OBJECTIVES

In this course student will learn about**:** Anatomy and physiology concepts of human body. The methods of measuring various biopotentials and physiological information from biomedical signals. The working principles of medical electronics equipment. The radiation for diagnostic and therapy. The techniques of electrical safety in Hospitals.

Course Outcomes (COs): At the end of the course, students will be able to

- **CO1:** Understand the function of human body and medical electronic equipment.
- **CO2:** Apply the safety aspects of medical instruments.
- **CO3:** Analyze various biomedical signals like ECG, EEG, EMGand transducers.
- **CO4:** Evaluate the patient condition by measuring various parameters like Pulse rate, blood pressure etc.

UNIT-I

Anatomy and physiology: Elementary ideas of cell structure, Heart and circulatory system, Central nervous system, Muscle action, Respiratory system, Body temperature and reproduction system.

UNIT-II

Overview of Medical Electronic Equipments: Classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments.

Electrodes: Bio electrodes, Electrode tissue interface, contact impedance, Types of Electrodes, Bioelectric signals, Electrodes used for ECG, EEG, X-Ray and CT Scan.

UNIT-III

Transducers: Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor, Bio Medical Recorders,Block diagram description and applications of ECG Machine, EEG Machine, EMG Machine.

UNIT-IV

Patient Monitoring Systems: Heart rate measurement, Pulse rate measurement, Respiration rate measurement, Blood pressure measurement, Principle of defibrillator and pace mark, Use of Microprocessor in patent monitoring.

UNIT-V

Safety Aspects of Medical Instruments: Gross current shock, Micro current shock, Special design from safety consideration, Safety standards.

TEXT BOOKS

R.S. Khandpur, Hand Book of Bio Medical Instrumentation, 2nd Edition.

REFERENCE BOOKS

1. Leslie Chromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio Medical instrumentation & Measurements – 2nd edition, PHI publishers.
2. Edward J. Bukstein, Sam and Co, Introduction to Bio Medical Electronics, Inc, USA.
3. L.A. Geddes and L.E.Baker, Principles of Applied Bio Medical Instrumentation

4. Armugam, Biomedical instrumentation, Anuradha Agencies

B.Tech. (VII Sem.) **17EC35 - ADVANCED MICROCONTROLLERS**

L	T	P	Cr.
3	-	-	3

Pre-requisites: Microprocessors and Microcontrollers, Computer Organization.

Course Educational Objective : In this course student will learn about the Architecture and instruction set to develop programs in assembly/C and design systems for real time applications by interfacing required memory/I/O devices.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: **Understand** the internal architecture and operation of PIC18F and MSP430 Microcontroller

CO2: **Apply** the instruction set and programming techniques for various applications.

CO3: **Analyze** the working of peripherals and devices for different applications.

CO4: **Design** microcontroller based solutions to real time problems

UNIT-I

PIC Microcontrollers and Instruction Set: PIC Micro-controllers – overview: features, PIC 16c6x/7xarchitecture, file selection register, Memory organization, Addressing modes, Instruction set, interrupt handling.

UNIT-II

Port structure, interrupt structure & timers of PIC18F, PWM generation UART, Interfacing of switches, LED, LCD, Keypad, Interfacing serial port, ADC, RTC with I2C and EEPROM with SPI. All programs in embedded C

UNIT-III

Case studies with PIC, Design of DAS system, Design of frequency counter with display on LCD, Design of Digital Multimeter, Design of DC Motor control using PWM

UNIT-IV

MSP430 Microcontroller Overview: Functional Block diagram of MSP430F2003-MemoryMapped CPU, Exceptions, Architecture of MSP430 Processor. A simple tour of MSP430- Light LED in C andAssembly Language,Read input from switch.

UNIT-V

Instruction Set and Addressing Modes of MSP430: Addressing Modes of MSP**,** Instruction Set, Function, Interrupts, Digital in-outs, Timer, Communication.

TEXT BOOKS

1. Mazidi, " PIC microcontroller & embedded system" 3rdEdition ,Pearson
2. John H. Davies, *"MSP430 Microcontroller Basics"*, Elsevier, 2008.

REFERENCE BOOKS

1. John B. Peatman, "Design with PIC Micro-controllers", Pearson Education Asia, Low Price Edition 53.
2. Manuel Jimenez, Rogelio Palomera, IsidoroConvertier, "*Introduction to Embedded systems using Microcontrollers and the MSP430",* Springer 2014.

L	T	P	Cr.
3	-	-	3

B.Tech. (VII Sem.) **17EC36 - MOBILE COMPUTING**

Pre-requisites: Telecommunication Switching Systems and Networks, Communication Networks.

Course Educational Objective: This course provides the basic knowledge on mobile communication, protocols and also various operating systems used in mobile communication.

Course Outcomes (COs): At the end of the course, students will be able to

CO1:	**Remember** the fundamental concepts of mobile communication
CO2:	**Understand** the basic concepts of mobile ad-hoc networks and various mobile platform used in layers
CO3:	**Analyze** the Performance protocols used in mobile communication.
CO4:	**Evaluate** the importance of each layer in mobile communication

UNIT-I

Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture.
GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.
MAC Protocols: Wireless MAC Issues, Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes.

UNIT-II

Mobile Network Layer: Mobile IP ,Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations, Dynamic Host Configuration Protocol (DHCP).

UNIT-III

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

UNIT-IV

Mobile AD-HOC Networks: Ad-Hoc Basic Concepts, Characteristics, Applications, Design Issues, Routing, Essential of Traditional Routing Protocols, Popular Routing Protocols, Vehicular Ad Hoc networks (VANET), MANET Vs VANET, Security.

UNIT-V

Mobile Platforms and Applications:
Mobile Device Operating Systems, Special Constrains & Requirements, Commercial Mobile Operating Systems, Software Development Kit: iOS, Android, BlackBerry, Windows Phone M-Commerce, Structure, Pros & Cons, Mobile Payment System, Security Issues.

TEXT BOOKS

1. Jochen Schiller, "Mobile Communications", Pearson Education. second edition, 2004.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012

REFERENCES

1. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications withUML and XML", Cambridge University Press,October 2004,
2. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
3. 3. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenović, "Mobile ad hoc networking", IEEE Press, Wiley InterScience, 2004.

L	T	P	Cr.
3	-	-	3

B.Tech. (VII Sem.) **17EC37 - DSP PROCESSORS**

PRE-REQUISITES: Digital Signal Processing, Microprocessor

COURSE OBJECTIVE: This course provides the knowledge on digital computational accuracy of systems and Architecture of various digital signal processors. The course will give an idea how memory and I/O devices can be interfaced to digital signal processors.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Remembering basic concepts of Digital signal processing techniques in both time and frequency domain.

CO2: Apply different parameters of computational accuracy in DSP implementation.

CO3: Analysebasic architectural requirements of programmable digital signal processors.

CO4: Design architectural aspects of TMS320C54XX and Analog devices family DSPs

UNIT-I

Introduction To Digital Signal Processing: A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time-invariant systems, Digital filters, Decimation and interpolation

UNIT-II

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-III

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-IV

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors

UNIT-V

Analog Devices Family of DSP Devices: Analog Devices Family of DSP Devices- ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP2100, ADSP-2181 high performance Processor.

Introduction to Blackfin Processor – The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals

TEXT BOOKS

Digital Signal Processing Implementations– Avatar Singh and S. Srinivasan, Thomson Publications

REFERENCES

1. Digital Signal Processors, Architecture, Programming and Applications – B.Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architecture & Features- Lapsley et al. 2000, S. Chand & Co.Press

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B.Tech. (VII Sem.)	17EC92 - COMMUNICATION NETWORKS (Add on course – III)	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Telecommunication Switching Systems and Networks

Course Educational Objective: This course provides knowledge on communication networks and various protocols used in different layers.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Remember the fundamental concepts of communication networks and reference models.
CO2	Understand design issues for constructing various layer protocols.
CO3	Analyze the performance of various protocols used in each layer.
CO4	Evaluate the importance of each layer.

UNIT-I

Introduction: Network hardware, Network software, Reference models-OSI reference model, TCP/IP model, Comparison between OSI and TCP/IP, Critique of the OSI reference model and TCP/IP mode.

Physical Layer: Guided transmission medium, Wireless transmission medium, Digital modulation and Multiplexing.

UNIT-II

Data Link Layer: Design issues, Error detection and correction codes, Elementary data link protocols, Sliding window protocols.

Medium Access Control Sublayer: Channel allocation problem, Multiple access protocols, Ethernet, Wireless LANs, Bluetooth.

UNIT-III

Network Layer: Design issues, Routing algorithms- Optimality principle, Shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing. Congestion control algorithms.

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UNIT-IV

Internetworking, Network layer in the internet- IPV4, IPV6, Comparison between IPV4 & IPV6, Internet control protocols, OSPF, BGP.

Transport Layer: Services provided to the upper layers elements of transport protocol-addressing connection establishment, connection release, Crash recovery.

UNIT-V

The Internet Transport Protocols UDP-RPC, Real Time Transport Protocols, The Internet Transport Protocols- Introduction to TCP, The TCP Service Model, The TCP Segment Header.

Application Layer: Domain name system, Electronic mail- Architecture and services, SMTP, World Wide Web-Architecture overview.

TEXT BOOKS

1. Tanenbaum and Wetherall, "Computer Networks", Pearson Education, Fifth Edition.
2. Behrouz. A. Forouzan, "Data Communication and Networking", Fourth Edition, Tata McGraw-hill, New Delhi, 2006

REFERENCES

1. S.Keshav," An Engineering Approach to Computer Networks", Pearson Education, 2nd Edition,
2. W.A.Shay,"Understanding communications and Networks", Cengage Learning, 3rd Edition
3. Chwan-Hwa (John) Wu, J. David Irwin," Introduction to Computer Networks and Cyber Security", CRC Press.
4. L.L.Peterson and B.S.Davie," Computer Networks", ELSE VIER, 4th edition.

B.Tech. (VII Sem.)	17EC71 - MICROWAVE AND OPTICAL COMMUNICATIONS LAB	L	T	P	Cr.
		-	-	2	1

Course Educational Objective : This Lab deals with the micro measurements of the signals at micro frequency range. It involves measurement of frequency, wave length, VSWR, Impedance and scattering parameters of various micro wave devices like Circulator, Direction Coupler, and Magic-Tee. Even the latest trend of communication technology i.e. fiber optics is also introduced and propagation conditions will be verified by evaluating the losses.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the various blocks of microwave bench setup

CO2: Evaluate thefrequency, wave length, VSWR, impedance and scattering parameters of various microwave devices

CO3: Analyze the losses to verify the propagating conditions in the optical fiber.

List of Experiments

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance Measurement.
7. Frequency Measurement.
8. Scattering Parameters of Circulator.
9. Scattering Parameters of Magic Tee.
10. Characterization of LED.
11. Characterization of Laser Diode.
12. Intensity modulation of Laser output through an optical fiber.
13. Measurement of Data rate for Digital Optical link.
14. Measurement of Numerical Aperture.
15. Measurement of losses for Analog optical link.

L	T	P	Cr.
-	-	2	1

B.Tech. (VII Sem.) **17EC72 - EMBEDDED SYSTEM DESIGN LAB**

Course Educational Objective : This Lab provides how to implement various applications on ARM processor using its powerful instruction set and thumb instruction set.

Course Outcomes (COs): At the end of the course, students will be able to

CO1 **Implement** Various real-time applications using ARM based processors

CO2 **Design** various systems by writing the programs on Xilinx FPGA Zynq 7000 series

Part I

- The following programs are to be implemented on **ARM based Processors/Equivalent.**
- **Minimum of 10 programs are to be conducted.**

1. ARM Assembly Language Programming-I
2. ARM Assembly Language Programming-II
3. Program to Interface 8 Bit LED
4. Program to demonstrate Time delay program using built in Timer / Counter feature
5. Program to Displaying a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
6. Program to implement Generation of PWM Signal on IDE environment
7. Program to demonstrate Serial Communication on IDE environment
8. Program to implement Traffic light Controller on IDE environment
9. Program to implement Stepper motor Controller on IDE environment
10. Basic Audio Processing on IDE environment.
11. Program to demonstrate I2C Interface on IDE environment
12. Program to implement Buzzer Interface on IDE environment

Part II

The following programs are to be implemented on **Xilinx FPGA Zynq 7000 series/Equivalent**.

- **Minimum of 2 programs are to be conducted.**

13. Design of System On Chip platform using Xilinx FPGAs and Embedded Development Kit Tools
14. Design dual processor based System on chip using Xilinx EDK Tools and Zynq 7000 series FPGA
15. Hardware Software co-design using Xilinx EDK Tools

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L	T	P	Cr.
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B.Tech. (VIII Sem.) 17EC38 - PROGRAMMABLE LOGIC DEVICES

Pre-requisites: Digital System design, VLSI Design.

Course Educational Objectives: This course enlightens the knowledge on simple Programmable logic devices, Complex Programmable Logic Devices, Field Programmable Gate Arrays, ASICs, ASIC library designs and ASIC programming technologies.

Course Outcomes (COs): At the end of this course, student will be able to

CO1: Understand the various types of Programmable Logic Devices
CO2: Analyze the architectures of Field Programmable Gate Arrays and ASICs
CO3: Evaluate the Programmable Logic Devices
CO4: Design of Application Specific Integrated Circuit libraries.

UNIT – I

Introduction to Programmable Logic Devices: Review of simple PLDs, Complex Programmable Logic Devices, Field Programmable Gate Arrays, Advantages fo FPGAs, Designing of FPGAs, Technology trends.

UNIT – II

Programming techniques of FPGAs: Introduction, SRAM Programming, Device architecture, design trade-offs, Xilinx XC2000, XC3000, XC4000 architectures, automated design implementations, technology specific synthesis, Antifuse programming technology, Device architectures, Routing architectures of FPGAs, Act1, Act2, Act3, Programming and testing.

UNIT – III

Introduction to ASICS: Full-custom ASICs, Standard Cell-based ASICs, Gate-Array based ASICs, Design flow, Economics of ASICs, Comparison between ASIC technologies, ASIC Cell Libraries.

UNIT – IV

ASIC Library Design: Transistors as Resistors, Transistor Parasitic Capacitance, Logical effort, Library cell design, Library architecture, Gate Array Design, Standard Cell Design, Data path Cell Design, EPROM and EEPROM technology.

UNIT – V

Programmable ASIC Logic Cells: Actel ACT, Xilinx, LCA, Altera FLEX, Altera MAX.
Programmable ASIC I/O Cells: DC and AC inputs and outputs, Clock input, Power inputs, Xilinx I/O blocks, Other I/O Cells.

TEXT BOOK

1. Stephen M. Trimberger, Field Programmable Gate Array Technology, Springer Publications, 1994.
2. M.J.S.Smith, Application Specific Integrated Circuits, Pearson Education Publications, 1997.

REFERENCE

1. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR Publications.
2. L.J.Herbst, Integrated circuit Engineering, Oxford University Press, 1996.

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B.Tech. (VIII Sem.)	17EC39 - REAL TIME OPERATING SYSTEMS FOR EMBEDDED SYSTEMS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Operating Systems

Course Educational Objective: This course provides the knowledge on Concepts of Operating Systems and Embedded Operating Systems, Real Time Operating Systems Objects, Services and I/O Exceptions, Interrupts and Timers, RTOS Programming Tools and Case Studies.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the basic concepts of Linux/UNIX systems and RTOS.

CO2: Analyze the fundamental concepts of objects, services and characteristics of RTOS.

CO3: Evaluate the effect of Interrupts and Timers in RTOS.

CO4: Create the Various applications using RT Linux, Vx works and Embedded Linux.

UNIT-I

Introduction: Introduction to Operating Systems, Operating System Services, basics of RTOS and Embedded Operating Systems.

Introduction to UNIX and LINUX, Overview of Commands, File I/O (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT-II

Real Time Operating Systems: Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, Task States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency.

Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use.

UNIT-III

Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem.

UNIT-IV

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT-V

RTOS Programming Tools and Case Studies: RT Linux, Micro C/OS-II, Vx Works, Embedded Linux, Tiny OS, and Basic Concepts of Android OS.

TEXT BOOKS

Qing Li, Real Time Concepts for Embedded Systems, Elsevier, 2011

REFERENCES

1. Rajkamal, Embedded Systems Architecture, Programming and Design TMH, 2nd Edition, 2008.
2. **Jane W.S.Liu, Real-Time Systems, Prentice Hall Publishers, 2000.**
3. Dr. Craig, Embedded Linux: Hardware, Software and Interfacing, Hollabaugh.

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B.Tech. (VIII Sem.)	17EC40 - RADAR SYSTEMS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Antenna Basics, Signal Processing Basics

Course Educational Objective: This course provides the knowledge on different types of RADARs with their operation and applications. The course gives an idea about different Tracking techniques and Radar subsystems. The course also gives the way to detect Radar signals in the presence of noise.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the basic concepts of Radar.

CO2: Analyze the CW Radar and FMCW Radar system for the measurement of speed and distance.

CO3: Apply the techniques to remove the clutter using MTI Radar and Pulse Doppler Radar.

CO4: Design the different tracking mechanisms and estimate the matched filter response.

CO5: Discriminate different Radar subsystems in both Transmitter and Receiver sections.

UNIT - I

Radar fundamentals: Radar range, Maximum Unambiguous Range, Multiple timearound echo, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Radar Applications, Prediction of Radar Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets-sphere, cone-sphere),Transmitter Power, PRF and Range Ambiguities, System Losses.

UNIT - II

Continuous Wave and Frequency Modulated Continuous Wave Radar: Doppler Effect,CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

UNIT - III

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with – PowerAmplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, Non-coherent MTI, MTI versus Pulse Doppler Radar.

UNIT - IV

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, MonopulseTracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

Detection of Radar Signals: Introduction, Matched Filter Receiver ResponseCharacteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

UNIT-V

Radar Equipment: Radar receivers -Noise Figure and Noise Temperature, Derivationfor expressions; Radar displays- Different types, significance; Radar duplexers-Branch type and Balanced type and Circulator type; Radar antennas-Basic Concepts, Radiation Pattern, Beam steering and Beam width changes, Series versus Parallel Feeds, Applications, Advantages and Limitations.

TEXT BOOKS

Merrill I. Skolnik ,"Introduction to Radar Systems" ,Second edition, McGraw-Hill, 1981.

REFERENCES

1. GSN Raju, "Radar Engineering and Navigationals aids", IK International Publishers, New Delhi.
2. G. Sasibhushana Rao, Microwave and Radar Engineering, Pearson Education publishers.

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B.Tech. (VIII Sem.)	17EC41 - NEURAL NETWORKS AND FUZZY CONTROL	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Threshold functions, Logic Gates

Course Educational Objective: This course provides the knowledge on Biological and Artificial Neuron Models. The course will give an idea about various learning and training algorithms of neural networks. The course also gives the complete information regarding Classical Sets, Fuzzy Sets, Conversion of crisp set to fuzzy set and Vice versa.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understandbiological and artificial Neuron Models and Fuzzy Sets.

CO2: Applyvarious learning and training algorithms of neural networks and Fuzzy Sets.

CO3: Analyzedifferent types of Associative Memories

CO4: DesignHopfield Networks for real time problems.

UNIT-I

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN-Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules

UNIT-II

Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category Training Algorithms, Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications

Multilayer Feed Forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Back propagation (BP) Training, Summary of Back propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT-III

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, ability Theorem.

UNIT-IV

Hopfield Network: Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis

UNIT-V

Classical Sets & Fuzzy Sets: Introduction to classical sets – properties, Operations and relations.

Fuzzy Sets: Fundamentals of fuzzy sets, basic fuzzy set relations, basic fuzzy set operations and their properties, fuzzy logic fundamentals, fuzzy control basics, a note on fuzzy control expert systems.

TEXT BOOKS

1. Simon Haykin"*Neural Networks and learning machines*" Prentice Hall, third edition 2009
2. S.N. Sivanandam, S. Sumthai, S.N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", Tata McGraw Hill Publications, India, 2005.

REFERENCES

1. Yegnanarayana.B, "*Artificial Neural Networks*", Prentice Hall of India Private Ltd., New Delhi, 1999 .
2. S.N.Sivanandam, S.Sumthai, S.N.Deepa, "*Introduction to Fuzzy Logic using MATLAB*", Springer Verlag Publishers Ltd, Germany,2007.
3. S.N.Sivanandam, S.N.Deepa, "*Principles of Soft Computing*", Wiley India Ltd, India, 2007.
4. Simon Haykin," Neural Networks - A comprehensive foundation ", Pearson Education, 2001.
5. James A Freeman and Davis Skapura, Neural Networks, Pearson Education, 2002

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B.Tech. (VIII Sem.)	17EC42 - RADIO FREQUENCY INTEGRATED CIRCUITS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Analog Electronics& Electromagnetic Field Theory.

Course Educational Objective: This course provides the knowledge on Basics of Radio frequency design, Device Modeling at Radio Frequency, about Low Noise Amplifiers, Mixers. Design of Oscillators, Frequency Synthesizers, RF Power Amplifiers and phase locked loops.

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Understand the Basic Concepts in RF Design

CO2: Develop Device Modeling and characteristics

CO3: Evaluating Low Noise Amplifiers and Mixers

CO4: Create RF Oscillators

CO5: Analyze Frequency Synthesizers Phase Locked Loops and RF Power amplifiers

UNIT-I

Introduction to RF and Wireless Technology: Complexity Comparison, Design Bottleneck, Application, Analog and Digital Systems, Choice of Technology.

Basic Concepts in RF Design: Nonlinearity and Time Variance, Intersymbol Interference, Random Process and Noise, Sensitivity and Dynamic Range, Passive Impedance and Transformation.

UNIT-II

Characteristics Of Passive IC Components: Introduction, Interconnect at Radio Frequencies: Skin Effect, Resistors, Capacitors, Inductors, Transformers, Interconnect Options at High Frequencies.

Active RF Component Modeling: Diode Models, Transistor Models, Measurement of Active Devices Scattering Parameter, Device Characterization.

UNIT-III

Low Noise Amplifiers and Mixers: Low Noise Amplifiers (LNAs)-General considerations, Input Matching, Bipolar PNAs, CMOS LNAs.

Conversion Mixers- General Considerations, Bipolar Mixers, CMOS Mixers, Noise in Mixers.

UNIT-IV

Oscillators: General considerations, Basic LC Oscillator Topologies, Voltage-Controlled Oscillators, Phase Noise, Bipolar and CMOS LC oscillators, Monolithic Inductors, Resonatorless VCOs, Quadrature Signal Generation, Single-Sideband Generation.

UNIT-V

Frequency Synthesizers: General considerations, Phase-Locked Loops, RF Synthesizer Architectures, Frequency dividers.

Power Amplifiers: General considerations, Classification of Power Amplifiers, High Efficiency Power Amplifiers, Large-Signal Impedance Matching, Linearization Techniques, and Design Examples.

TEXTBOOKS

1. Behzad Razavi "RF Microelectronics", John Wiley, 2006.
2. Thomas Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2nd Edition.

REFERENCES

1. Reinhold Ludwig and Pavel Bretchko, "RF Circuit Design **:** Theory and Applications", Pearson Education Publications
2. Donald O.Pederson and Kartikeya Mayaram, "Analog Integrated Circuits forCommunication Principles".

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B.Tech. (VIII Sem.) **17EC43 - DESIGN FOR INTERNET OF THINGS**

Pre-requisites: Microprocessors and Microcontrollers, Embedded Systems, Computer Networks.

Course Educational Objective: This course provides the knowledge on technologies involved in IoT Development, IoT supported hardware platforms- Rasberry pi, ARM Cortex Processors, Arduino, IoT architecture for performance and security aspects, IoT application development using various protocols and Big data, visualization issues in IoTs

Course Outcomes (COs): At the end of the course, students will be able to

CO1:	**Understand** technologies involved in IoT Development
CO2:	**Design** IoT platform using Raspberry pi, ARM and Arduino Processors.
CO3:	**Analyze** IoT architecture for performance and security aspects.
CO4:	**Develop** IoT application using various protocols.
CO5:	**Identify** Big Data and Visualization issues in IoT .

UNIT-I

The IoT Networking Core : Technologies involved in IoT Development: Internet/Web and Networking Basics OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing

UNIT-II

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

UNIT-III

IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling,Performance Analysis The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN Security aspects in IoT

UNIT-IV

IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL Back-end Application Designing Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools

UNIT-V

Case Study & advanced IoTApplications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

TEXT BOOKS

1. Zach Shelby, Carsten Bormann: 6LoWPAN: The Wireless Embedded Internet, , Wiley,1st Edition
2. Dr. OvidiuVermesan, Dr. Peter Friess :Internet of Things: Converging Technologies for Smart Environments and IntegratedEcosystems, , River Publishers.
3. Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann, Interconnecting Smart Objects with IP: The Next Internet, Elsevier, 1st Edition

REFERENCE BOOKS

1. Lu Yan, Yan Zhang, Laurence T. Yang, HuanshengNing : The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems, Auerbach Publications ,Taylor & Francis Group
2. Vijay Madisetti ,ArshdeepBahga : Internet of Things (A Hands-on-Approach),1st edition
3. Adrian McEwen (Author), Hakim Cassimally : Designing the Internet of Things,Wiley, 1st edition.

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B.Tech. (VIII Sem.) **17EC44 - WIRELESS SENSOR NETWORKS**

Pre-Requisites: Wireless Communication and Networks

Course Educational Objective: This course provides the knowledge on applications, architectures and protocols of wireless sensor networks. This course gives an idea about controlling, clustering and positioning in sensor networks. It also gives the overview regarding the software platforms and tools required for wireless sensor networks.

Course Outcomes (COs): At the end of the course, student will be able to

CO1: **Understand** different applications of Wireless Sensor Networks.
CO2: **Analyze** the architecture of a single node and Wireless Sensor Network.
CO3: **Evaluate** different communication protocols of wireless sensor networks in real time applications.
CO4: **Design** infrastructure establishment of wireless sensor networks.
CO5: **Apply** the knowledge of sensor network platforms and tools for the development of wireless sensor networks.

UNIT – I

Overview of Wireless Sensor Networks: Applications of Wireless Sensor Networks- Application examples, Types of applications; Unique constraints and Challenges for Wireless Sensor Networks- Characteristic Requirements, Required mechanisms; Advantages of Sensor Networks, Collaborative processing and Key definitions, Difference between Mobile Ad hoc and Sensor Networks, Classification of Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks.

UNIT – II

Architectures: Single Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes- Operating states with different Power Consumption, Energy consumption of Transceiver, Micro controller and Memory; Dynamic Voltage Scaling, Relation between Computation and Communication, Operating Systems and Execution Environments, Some examples of Sensor nodes; Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT – III

Networking Sensors: Wireless channel and Communication fundamentals, Physical Layer and Transceiver design considerations in WSNs; MAC Protocols for Wireless Sensor Networks, Low Duty Cycle protocols and Wakeup concepts- S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts; Routing Protocols- Energy efficient routing, Geographic routing.

UNIT – IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control- Task driven sensing, Role of sensor nodes and utilities, Information based sensor tasking.

UNIT – V

Sensor Network Platforms and Tools: Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TEXT BOOKS

1. Feng Zhao & Leonidas J. Guibas, *"Wireless Sensor Networks- An Information Processing Approach"*, Elsevier, 2007.
2. Holger Karl & Andreas Willig,*"Protocols and Architectures for Wireless Sensor Networks",* John Wiley & Sons, 2005.

REFERENCES

1. KazemSohraby, Daniel Minoli, &TaiebZnati, *"Wireless Sensor Networks- Technology, Protocols, And Applications",* John Wiley, 2007.
2. Anna Hac, *"Wireless Sensor Network Designs",* John Wiley, 2003.
3. C. S. Raghavendra, K.M. Sivalingam and T. Zanti*, "Wireless Sensor Networks",*Springer Verlag, Sep. 2006.
4. WaltenegusDargie, & Christian Poellabauer,*"Fundamentals of Wireless Sensor Networks- Theory and Practice",*John Wiley, 2010.

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B.Tech. (VIII Sem.) **17EC45 - BIO MEDICAL SIGNAL PROCESSING**

L	T	P	Cr.
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Pre-requisites : Digital Signal Processing

Course Educational Objective: This course provides the knowledge on biomedical signals. The course will give an idea about various characteristics of EEG and ECG signals in diagnosing. The course also gives the information about adaptive interference and noise cancellation.

Course Outcomes (COs): At the end of the course, students will be able to

CO1:	Analyze EEG signal characteristics using linear prediction theory.
CO2:	Evaluate ECG signals parameters using QRS technique.
CO3:	Apply adaptive filtering techniques for noise cancellation and data compression techniques on ECG data..
CO4:	Understand Prony's methods used in clinical applications.

UNIT-I

Neurological Signal Processing:

Brain and its potentials, Electrophysiology origin of Brain waves, EEG Signals and its Characteristics, EEG Analysis, Linear prediction theory, The autoregressive(AR) method, Recursive Estimation of AR parameters, Spectral Error measure, Adaptive segmentation, Transient Detection and Elimination, Overall performance.

UNIT-II

Cardio logical Signal Processing:

Basic Electrocardiography, ECG Data Acquisition, ECG Lead system, ECG Parameters and their estimation: ECG QRS Detection Technique, Estimation of R-R Interval, Estimation of ST Segmentation Inclination.

UNIT-III

Adaptive Interference/Noise Cancellation

A review of the Wiener Filtering Problem, Principle of an Adaptive Filter, The Steepest-Descent Algorithm, Windrow-Hoff Least- Mean-Square Adaptive Algorithm, Adaptive Noise Canceller: Cancellation of 60Hz Interference in Electrocardiography, Cancelling Donor –heart Interference inHeart-transplant Electrocardiography, Cancelling of Maternal ECG in Fetal Electrocardiography, Cancellation of High Frequency Noise in Electro-surgery.

UNIT-IV

ECG Data Reduction Techniques:

Direct Data compression Technique, Direct ECG Data Compression Techniques, Transformation Compression Technique, Other Data Compression technique Comparison.

UNIT-V

Prony's Methods : Exponential Modeling ,Exponential parameter estimation ,The original Prony Problem, Least Squares Prony Method, The Covariance Method of Linear Predication, Prony's Method in the presence of Noise, Clinical Applications of Prony's Method.

TEXT BOOKS

D.C.Reddy, 'Biomedical Signal Processing- Principles and Techniques', 2005, TMH.

REFERENCES

1. MitenAkay, 'Biomedical Signal Processing' Academic Press, Inc 1994
2. Cohen.A'Biomedical Signal Processing -Vol. I Time & Frequency Analysis, 1986, CRC Press.