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	17CI01	Computer Programming	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	17CI60	Computer Programming Lab	-	-	2	2	1	40	60	100
9	17ME75	Computer Aided Engineering Drawing Lab	1	-	2	3	2	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	17EI01	Material Science and Engineering	2	2	-	4	3	40	60	100
5	17EC02	Electronic Devices and Circuits	2	2	-	4	3	40	60	100
6	17FE62	Applied Physics Lab	-	-	2	2	1	40	60	100
7	17FE60	English Communication Skills Lab	-	-	2	2	1	40	60	100
8	17EC61	Electronic Devices and Circuits Lab	-	-	2	2	1	40	60	100
9	17ME60	Engineering Workshop	1	-	2	3	2	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	17FE03	Environmental Science	3	-	-	3	3	40	60	100
3	17EE53	Electrical Technology	2	2	-	4	3	40	60	100
4	17EI02	Transducers	2	2	-	4	3	40	60	100
5	17EC03	Analog Electronic Circuits	2	2	-	4	3	40	60	100
6	17EC04	Digital Electronic Circuits	2	2	-	4	3	40	60	100
7	17EE73	Electrical Technology Lab	-	-	2	2	1	40	60	100
8	17EI60	Transducers Lab	-	-	2	2	1	40	60	100
9	17EC62	Analog and Digital Electronic Circuits Lab	-	-	2	2	1	40	60	100
10	17PD01	Problem Assisted Learning	-	-	1	1	0	100	-	100
		Total	**14**	**10**	**7**	**31**	**22**	**460**	**540**	**1000**

IV SEMESTER

S. No	Course code	Course Title	Contact hours/week				Credits	Scheme of Valuation		
			L	T	P	Total		CIE	SEE	Total
1	17FE09	Functions of Complex Variables	3	2	-	5	4	40	60	100
2	17ME52	Fundamentals of Fluid Mechanics	3	-	-	3	3	40	60	100
3	17EI03	Electrical and Electronics Measurements	3	-	-	3	3	40	60	100
4	17EI04	Industrial Instrumentation	3	-	-	3	3	40	60	100
5	17EC05	Signals and Systems	2	2	-	4	3	40	60	100
6	17EC07	Pulse and Switching Circuits	2	2	-	4	3	40	60	100
7	17ME77	Engineering Fluid Mechanics Lab	-	-	2	2	1	40	60	100
8	17EC63	Pulse and Switching Circuits Lab	-	-	2	2	1	40	60	100
9	17EI61	Electrical and Electronics Measurements Lab	-	-	2	2	1	40	60	100
10	17PD03	Professional Ethics and Human Values	3	-	-	3	0	40	60	100
11	17PD02	Problem Based Learning	-	-	1	1	0	100	-	100
		Total	**19**	**6**	**7**	**32**	**22**	**500**	**600**	**1100**

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	17EI05	Communication Systems	3	-	-	3	3	40	60	100
3	17EC22	Microprocessorsand Microcontrollers	3	-	-	3	3	40	60	100
4	17EI06	Integrated Circuits and Applications	3	-	-	3	3	40	60	100
5	17EI07	Control Systems Engineering	3	-	-	3	3	40	60	100
6	**PROGRAM ELECTIVE – I**		3	-	-	3	3	40	60	100
	17EC16	VLSI Design								
	17EI08	Industrial Electronics								
	17EI09	Intelligent Instrumentation								
	17IT81	Computer Networks								
7	17EC70	Microprocessorsand Microcontrollers Lab	-	-	2	2	1	40	60	100
8	17EI62	Integrated Circuits and Applications Lab	-	-	2	2	1	40	60	100
9	17PD04	Mini Project	-	-	4	4	2	100	-	100
10	17EI90	Safety Instrumentation **(*Add on course – I)**	3	-	-	-	3	40	60	100
11	17PD05	Employability Enhancement Skills-I	1	-	-	1	0	100	-	100
12	17PD06	Industrial Training/ In-house Training	-	-	-	-	-	-	-	-
		Total	**22**	**-**	**8**	**27**	**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	17EI10	Process Control Instrumentation	2	2	-	4	3	40	60	100
2	17EI11	Bio Medical Instrumentation	2	2	-	4	3	40	60	100
3	17EC10	Digital Signal Processing	2	2	-	4	3	40	60	100
4	17EI12	Opto Electronics and Laser Instrumentation	3	-	-	3	3	40	60	100
5	**PROGRAM ELECTIVE – II**		3	-	-	3	3	40	60	100
	17EI13	Virtual Instrumentation								
	17ME53	Industrial Robotics								
	17EC44	Wireless Sensor Networks								
	17EI14	Optimal Control								
6	**OPEN ELECTIVE – I**		3	-	-	3	3	40	60	100
7	17EI63	Process Control Instrumentation Lab	-	-	2	2	1	40	60	100
8	17EI64	Optical and BMI Lab	-	-	2	2	1	40	60	100
9	17FE61	Presentation Skills Lab	-	-	2	2	1	40	60	100
10	17PD07	Seminar	-	-	2	2	1	100	-	100
11	17EI91	Remote Sensing **(*Add on course – II)**	3	-	-	-	3	40	60	100
12	17PD08	Employability Enhancement Skills-II	1	-	-	1	0	100	-	100
		Total	**19**	**6**	**8**	**30**	**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	17EI15	PC Based Instrumentation	2	2	-	4	3	40	60	100
2	17EI16	PLC and SCADA	2	2	-	4	3	40	60	100
3	17EI17	Analytical Instrumentation	2	2	-	4	3	40	60	100
4	**PROGRAM ELECTIVE – III**		3	-	-	3	3	40	60	100
	17EI18	Micro Electro Mechanical Systems								
	17EI19	System Identification and Adaptive control								
	17EI20	Instrumentation Control in Paper Industries								
	17EI21	Instrumentation in Aerospace and Navigation								
5	**PROGRAM ELECTIVE – IV**		3	-	-	3	3	40	60	100
	17EI22	Automation of Industrial Process								
	17EC33	Digital Image Processing								
	17EC41	Neural Networks and Fuzzy Control								
	17EI23	Instrumentation in Petro Chemical Industries								
6	**OPEN ELECTIVE – II**		3	-	-	3	3	40	60	100
7	17EI65	Analytical instrumentation and PC Based Instrumentation Lab	-	-	2	2	1	40	60	100
8	17EI66	Programmable Logic Controllers Lab	-	-	2	2	1	40	60	100
9	17PD09	Internship	-	-	1	1	2	100	-	100
10	17EI92	Telemetry and Telemedicine **(*Add on course – III)**	3	-	-	-	3	40	60	100
11	17PD10	Extra-curricular/Co-curricular Activities	-	-	1	1	-	-	-	-
		Total	**18**	**6**	**6**	**27**	**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
	17EI24	Advanced Sensors								
	17EI25	Advanced Process Control								
	17EC35	Advanced Microcontrollers								
	17EI26	Advanced Control System Design								
2	**PROGRAM ELECTIVE – VI**		3	-	-	3	3	40	60	100
	17EI27	Power Plant Instrumentation								
	17EC29	Embedded System Design								
	17EI28	Automotive Sensors								
	17EC19	Advanced Digital 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

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.

REFERENCE
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.

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

L	T	P	Cr.
2	2	-	3

B.Tech. (I Sem.) **17CI01 - COMPUTER PROGRAMMING**

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. (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.

REFERENCE
Lab manual

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

Course Educational Objective : This course provides the 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.

L	T	P	Cr.
-	-	2	1

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

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. (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.

REFERENCE
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. (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, 1st Edition, 2009.

B.Tech. (II Sem.) 17EI01 - MATERIAL SCIENCE AND ENGINEERING

L	T	P	Cr.
2	2	-	3

Pre-requisites: Engineering Chemistry

Course Educational Objective :

In this course, student will learn about the basic concepts of crystals, magnetic materials, variation in bonding and their properties along with super conductors and variety of optical materials and real time applications.

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

CO1: Analyse different magnetic, optical and superconducting materials based on their properties.

CO2: Discuss the concept of superconductivity, types of superconductors along with different magnetic materials by means of their critical parameters.

CO3: Analyse the structure of different materials and their properties through chemical bondings.

CO4: Describe the concepts of fluorescence and phosphorescence used in different display devices.

CO5: Compare new smart materials viz., nano-phase materials, polymers etc by means of their properties and applications.

UNIT – I

CRYSTAL GEOMETRY, STRUCTURE AND CHEMICAL BONDING

Geometry of Crystal: The Space Lattices, Space Lattices and Crystal Structures, Crystal Direction and Planes, Structure Determination by X-Ray Diffraction, The Bragg Law of X-Ray Diffraction, The Powder Method, Structure Determination.

CHEMICAL BONDING: Bond Energy, Bond Type, Bond Length, Ionic Bonding, Metallic Bonding, Secondary Bonding, Variation in Bonding Character and Properties, The Crystalline and the Non Crystalline States,Covalent Solids, Metals and Alloys, Ionic Solids

UNIT – II

MAGNETIC MATERIALS

Introduction, different types of magnetic materials, Classical theory of diamagnetism (Langevin theory), Langevin theory of paramagnetism, Weiss theory of paramagnetism, Weiss theory (or) Molecular field theory on ferromagnetism, Heisenberg interpretation on internal field and quantum theory of ferromagnetism, Domain theory of ferromagnetism, Hard and soft materials.

UNIT – III

SUPERCONDUCTING MATERIALS

Introduction, Explanation for the occurrence of superconductivity, general properties of superconductor, Other General Observations, Types of superconductors, High temperature superconductors, Applications of superconductors.

UNIT – IV

OPTICAL MATERIALS

Introduction, Optical Absorption in Metals, Semiconductors and Insulators, Non Linear Optical Materials and their Applications, Optical Modulators, Optical Fiber Materials, Display Devices and Display Materials: Fluorescence and Phosphorescence, Light Emitting Diodes, Liquid Crystal Display.

UNIT – V

NEW MATERIALS

Introduction, Metallic Glasses, Biomaterials, Ceramics, High Temperature Materials, Thermoelectric Materials, Nanophase Materials: Introduction, Preparation of Nanomaterials, Applications, Intermetallic Compounds, Shape Memory Alloys, SMART Materials, Conducting Polymers.

TEXT BOOKS

1. Dr. M.Arumugam, "Materials Science", 3rdEdition, Anuradha Publications, 2007.
2. V. Raghavan, "Materials Science and Engineering", 3rd Edition, PHI, 1996.

REFERENCES

1. Rolf E. Hummel, "Electronic Properties of Materials", 4th Edition, Springer, New York, 2011.
2. Dennis W. Prather, "Photonic Crystals: Theory, Applications, and Fabrication", John Wiley & Sons, Hoboken, 2009.
3. James R. Janesick, "Scientific Charge-Coupled Devices", Published by SPIE The International Society for Optical Engineering, Bellingham, Washington, 2001.
4. David M. Pozar, "Microwave Engineering", 3rd Edition, John Wiley & Sons, 2005.
5. F. Silver and C. Dillion, "Biocompatibility: Interactions of Biological and Implantable Materials", VCH Publishers, New York, 1989.

B.Tech. (II-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.

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.) 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.

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

L	T	P	Cr.
1	-	2	2

PRE-REQUISITES: Knowledge in dimensions and units, Usage of geometrical instruments and analytical ability

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 : Fabricate and model various basic prototypes in the trade of fitting such as Straight fit, V- fit.
CO3 : Produce various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder.
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
Job III -Preparation of Mortise and 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. (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.)	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. (III Sem.) **17EE53 - ELECTRICAL TECHNOLOGY**

L	T	P	Cr.
2	2	-	3

Pre-requisites **:** Electrical circuits and Networks(17EC01)

Course Educational Objective: This course enables the student to demonstrate the construction and working principle of AC & DC Machines.

Course Outcomes: At the end of the course, the student will be able to :
CO1: Illustrate the construction and working of different types of D.C machines
CO2: Determine the performance of D.C machines
CO3: Differentiate the construction and principle of operation of A.C machines
CO4: Analyze the performance of A.C Machines

UNIT – I : D C GENERATORS
Principle of operation of DC generator-simple loop generator, Construction, Commutator, EMF equation, Types of DC generators, Characteristics of DC Generator, numerical problems.

UNIT – II: D.C. MOTORS
Principle of working of DC Motor, Types of DC Motors ,Characteristics of DC motors , Starting methods,3-point starter ,Losses and efficiency Calculation - Swinburne's test, Speed control of DC shunt motor – Flux and Armature control methods.

UNIT – III : SINGLE PHASE TRANSFORMERS
Principle of operation of single phase transformer, types, constructional features, Equivalent Circuit, Losses. Performance of Transformers: Regulation and Efficiency Calculation, Condition for Maximum Efficiency, OC and SC tests, numerical problems.

UNIT – IV : THREE PHSE INDUCTION MOTORS
Principle of operation of Induction Motors- Types of rotors: Slip ring and Squirrel cage rotors, Slip- rotor emf and current-torque-starting torque-condition for Maximum Torque –Slip-Torque characteristics.

UNIT – V : ALTERNATORS
ALTERNATORS: Fundamentals of Poly Phase voltage/current waveforms,3-phase Alternators – Constructional features , Principle and operation of alternators ,Salient pole and Non-Salient pole rotors , EMF Equation ,Definitions of Distribution and Coil span factors, Voltage Regulation - synchronous impedance method only. Numerical problems.

TEXT BOOKS
1. M.S Naidu and S. Kamakshaiah, Introduction to Electrical Engineering –TMH Pub,2012.
2. I.J. Nagarath and D.P Kothari, Theory and Problems of basic electrical engineering, PHI Publications, 3rd Edition, 2016.

REFERENCES
1 T.K. Nagasarkar and M.S.Sukhija, " Basic Electrical Engineering", Oxford University Press, 2005.
2. B.L.Theraja and A.K.Theraja, "A Text of Electrical Technology", S.Chand Publications, Volume-2.
3. V.K Mehta, "Principles of Electrical Engineering", S.Chand Publications,2006.

L	T	P	Cr.
1	-	2	2

B.Tech. (III Sem.) **17EI02 - TRANSDUCERS**

Pre-requisites: Electrical Circuits and Networks

Course Educational Objective: In this course, student will learn about the basic operational characteristics of measurement systems, active transducers and signal conditioning circuits along with working principles of various resistive sensors

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

CO1: Interpret the static and dynamic characteristics of measurement system.

CO2: Infer the operation of various types of resistive sensors along with their signal conditioning circuits.

CO3: Classify the operation of various types of Capacitive and Inductive sensors

CO4: Evaluate the performance ofvarious signal conditioning circuits for reactive type of sensors.

CO5: Analyze the operation of self generating sensors and their signal conditioning.

UNIT – I

INTRODUCTION TO MEASUREMENT SYSTEMS

General concepts and terminology, measurement systems, sensor classification, general input-output configuration, methods of correction. Performance characteristics: static characteristics of measurement systems, accuracy, precision, sensitivity, other characteristics: linearity, resolution, systematic errors, random errors, dynamic characteristics of measurement systems: zero-order, first-order, and second-order measurement systems and response.

UNIT – II

RESISTIVE SENSORS& SIGNAL CONDITIONING

Potentiometers, strain gauges and types, resistive temperature detectors (rtds), thermistors, magneto resistors, light-dependent resistor(ldr). Measurement of resistance, voltage dividers, Wheatstone bridge. Balance and deflection measurements, sensor bridge calibration and compensation instrumentation amplifiers, interference types and reduction.

UNIT – III

REACTANCE VARIATION AND ELECTROMAGNETIC SENSORS

Capacitive sensors – variable & differential, inductive sensors - reluctance variation, eddy current, linear variable differential transformers (lvdts) , magneto elastic sensors, electromagnetic sensors - sensors based on faraday‘s law, hall effect sensors.

UNIT – IV

SIGNAL CONDITIONING FOR REACTANCE VARIATION SENSORS

Problems on reactance parameters, AC bridges, Carrier Amplifiers and Coherent Detection, Specific signal conditioners for capacitive sensors, Resolver-to-Digital and Digital-to-Resolver Converters.

UNIT – V

SELF-GENERATING SENSORS AND SIGNAL CONDITIONING

Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. Chopper and low-drift amplifiers, offset and drifts amplifiers, electrometer amplifiers, charge amplifiers, noise in amplifiers

TEXT BOOKS

1. Ramon PallásAreny, John G. Webster Sensors and Signal Conditioning Wiley India 2nd edition 2000.
2. D. Patranabis Sensors and Transducers, TMH 2003.

REFERENCES

1. E.O.Doeblin Measurement System Applications and Design- Tata McGraw Hill Publications.
2. A.K.Sawhney Electrical and Electronic Measurements and Instrumentation Dhanpat Rai &Co Publication Ltd

B.Tech. (III Sem.) **17EC03 - ANALOG ELECTRONIC CIRCUITS**

L	T	P	Cr.
2	2	-	3

COURSE EDUCATIONAL OBJECTIVES : In this course student will learn about

- Analysis of single stage and multistage amplifiers
- Frequency response of single stage and multistage amplifiers.
- Different power amplifiers and tuned amplifiers.
- Concept of negative feedback in amplifiers.
- Operation, types and stability of Oscillators.

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

CO1 :Design different single stage and multistage amplifiers.
CO2 :Understand the effect of capacitances on frequency response.
CO3 :Understand the applications of power and tuned amplifiers.
CO4 :Know the importance of negative feedback in amplifiers.
CO5 :Design Sinusoidal oscillator for different frequencies

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. (III 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.

L	T	P	Cr.
-	-	2	1

B.Tech. (III Sem.) **17EE73 - ELECTRICAL TECHNOLOGY LAB**

Pre-requisites : Electrical Technology(17EE53).

Course Educational Objective: This lab course enables student to demonstrate the usage of electrical equipment, methods of analysis of electrical circuits and analyze the performance of electrical machines.

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

CO1. Analyse electrical circuits with ac and dc excitations

CO2. Evaluate transient response of simple circuits with capacitors/ inductors

CO3. Analyse the performance of electrical machines

List of Experiments

Cycle-I : Electrical Circuits

1. Measurement of active & reactive powers in a series R-L and R-C circuits
2. Calculation of Resonant frequency, Bandwidth, Quality factor for RLC resonant circuits (Series, Parallel).
3. Verification of maximum power transfer theorem (both AC and DC excitations)
4. Determination of self, mutual inductances and coefficient of coupling for a coupled coil.
5. Determination of time constant and steady state error of first order RC/RL network (for sinusoidal and non-sinusoidal inputs).
6. Transient analysis of series RL /RC Circuit using software tools
7. Study of fluorescent lamp and determination of choke coil parameters.

Cycle-II: Electrical Machines

1. Plot the load characteristics of D.C shunt generator.
2. Determination of critical field resistance and critical speed of dc shunt generator based on magnetization characteristics
3. Control the speed of DC Shunt motor by Armature control and Field control methods
4. Predetermination of efficiency of a given DC Shunt machine working as a motor and as a generator using Swinburne's test.
5. Predetermination of efficiency and voltage regulation of a single phase transformer based on O.C & S.C tests for a given load current and power factor and also draw its equivalent circuit.
6. Determination of voltage regulation of 3-phase Alternator by using Synchronous Impedance method
7. Plot the torque - slip characteristics of 3-phase Induction motor using software tools.

Note: **Conduct any five experiments from each cycle.**

L	T	P	Cr.
-	-	2	1

B.Tech. (III Sem.) **17EI60 - TRANSDUCERS LAB**

Pre-requisites: Electrical Circuits & Networks Lab

Course Educational Objective : In this course, student will learn about the measurement of different physical parameters like temperature, pressure, displacement, force, strain using resistive, Capacitive and Inductive transducers.

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

CO1: Identify suitable instruments to meet the requirements of industrial applications

CO2: Plan and carry out measurements of physical quantities commonly encountered by instrumentationengineers using laboratory instruments.

CO3: Analyze the performance characteristics of various transducers and infer the reasons for the behavior.

CO4: Select appropriate passive or active transducers for measurement of physical phenomenon

LIST OF EXPERIMENTS:

1. Measurement of Strain using Strain gauge.
2. Measurement of Temperature using RTD
3. Measurement of Displacement using LVDT.
4. Measurement of Displacement using Capacitive transducer.
5. Measurement of Force using Piezoelectric transducer.
6. Measurement of Pressure using Bourdon tube.
7. Measurement of Temperature using Thermocouple
8. Measurement of Speed using Photoelectric and Magnetic pick-ups
9. Measurement of Temperature using Thermistor
10. Measurement of Displacement using LDR.
11. Measurement of Torque.
12. Load Cell

NOTE: Minimum 10 experiments can do in above mentioned experiments

B.Tech. (III Sem.)	17EC62 - ANALOG AND DIGITAL ELECTRONIC 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. (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.

B.Tech. (IV Sem.) 17ME52 - FUNDAMENTALS OF FLUID MECHANICS

L	T	P	Cr.
3	-	-	3

Pre-requisites:

Course Educational Objective: In this course student will learn about to understand fundamentals of fluids, flow measuring devices, performance of turbines and pumps.

Course Outcomes : At the end of the course, the student will be able to :
CO1: Describe the properties of fluid and laws of pressure
CO2: Categorize types of flows, hydraulic pumps and turbines
CO3: Demonstrate working of pressure measurement and flow measurement devices
CO4: Formulate dimensionless numbers by Rayleigh's method and Buckingham's method
CO5: Evaluate performance of hydraulic pumps and turbines
.

UNIT-I
BASIC CONCEPTS OF FLUID MECHANICS
Introduction-Classification-Types of fluids-Properties-Density, Specific volume, Specific gravity, Specific weight,Viscosity,Surfacetension,Capillarity,Laws of pressure-Atmospheric pressure, Gauge pressure, Absolute pressure,Vaccum pressure-Pressure measurement-Manometers

UNIT-II
FLUID KINEMATICS &FLUID DYNAMICS
Introduction- Classification of Flows-Steady &Un Steady, Uniform and Non Uniform, Laminar, Turbulent, Rotational and Irrotational Flows -Velocity-Continuity equation-Energy of a liquid in motion-Head of a liquid-Bernoulli's theorem-Venturi meter-Orifice meter -Pitot tube

UNIT-III
DIMENSIONAL AND MODEL ANALYSIS
Introduction-Dimensions-Dimensional analysis-Rayleigh's method-Buckingham's method-Similitude -Dimensionless numbers and their significance-Similarity loss

UNIT-IV
HYDRAULIC TURBINES
Classification of Turbines, Pelton Wheel, work done and efficiencies of Pelton Wheel, Working proportions of Pelton Wheel, Francis Turbine, work done and efficiencies of Francis Turbine, Working proportions of Francis Turbine, Kaplan Turbine, work done, heads& efficiencies

UNIT-V
HYDRAULIC PUMPS
Introduction-Reciprocating pump-construction details-Coefficient of discharge-Slip and power-Centrifugal pumps-Classification –Working principle-Specific speed

TEXT BOOKS
1. P.N.Modi and S.M.Seth, Hydraulics, "Fluid Mechanics and Hydraulic Machinery", 15th Edition, Standard Book House, 2004.
2. Philip J, Robert W.fox, "Fluid mechanics",7th edition, John Wiley &sons,2011.

REFERENCES

1 R.K.Bansal, "Fluid Mechanics and Hydraulic Machines", 9th Edition, laxmi publications.
2. Banga& Sharma," HydraulicMachine"s, Edition, Khanna publishers, 6th Edition,1999
3. RamaDurgaiah, "Fluid Mechanics and Machinery", Edition, New Age International, 1stedition,2006
4. D.S. Kumar, "Fluid Mechanics and Fluid power engineering", 5th Edition, S.K. Kataria& Sons

B.Tech. (IV Sem.)	17EI03 - ELECTRICAL AND ELECTRONICS MEASUREMENTS	L	T	P	Cr.
		3	-	-	3

Pre-requisites: Applied Physics & EDC

Course Educational Objective : In this course, student will learn about Various types of measurement errors, , Voltmeters, Ammeters, ohm meters, AC DC bridges, Oscilloscope, calibration and various standards of Measurements

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

CO1: Explore the errors, calibration, direct & indirect standards of measurement for statistical analysis.

CO2: Analyze the working of electro-mechanical indicating instruments (PMMC , galvanometer, voltmeters, ammeters, ohmmeter) for measuring the parameters (V & I) in industries.

CO3: Identify & Select suitable AC/DC bridges for measuring parameters like R, L & C.

CO4: Measurement of AC/DC voltages using rectifiers, electronic multi-meter & digital voltmeters.

CO5: Analyze the functions of CRO, Spectrum analyzers and Recorders (Magnetic and X-Y) to meet the desired needs within realistic constraints.

UNIT – I

ERRORS,CALIBRATION& STANDARDS OF MEASUREMENTS

Definitions- Accuracy Vs Precision-significant figures-types of errors- Statistical analysis – probability of errors. Calibration: introduction-process instruments calibration. Standards:classification-standard for mass-length-volume-time and frequency standards-electricalstandards-IEEE standards.

UNIT – II

ELECTRO MECHANICAL INDICATING INSTRUMENTS

Suspension galvanometer-torque & deflection of galvanometer-PMMC mechanism – DCAmmeters-DC voltmeters-voltmeter sensitivity- Series and shunt type of Ohm meter-Calibration of DC instruments and AC instruments- AC indicating instruments-thermoinstruments-Electro Dynamo Meter in power measurement-Watt hour Meter –power factormeter-introduction to Instruments transformers.

UNIT – III

BRIDGE MEASUREMENTS

Introduction Bridges-DC BRIDGES: Wheatstone bridge-Kelvin double bridge-AC BRIDGES: Maxwell Bridge-Hay's Bridge -Schering Bridge-Anderson's bridge –Wein Bridge, Q- meter.

UNIT – IV

ELECTRONIC INSTRUMENTS

AC voltmeter using rectifiers, true RMS reading voltmeter, electronic multimeter, digitalvoltmeter DVM, staircase ramp DVM, dual slop DVM and successive approximation DVM- 3

½ Digit – Resolution and sensitivity of Digital voltmeters.

UNIT – V

OSCILLOSCOPES, ANALYZERS AND RECORDERS

CRO block diagram operation- CRT operation- CRO probes- frequency and phasemeasurement using lissajous figures, storage oscilloscope.Spectrum analyzers, -wave analyzer-Harmonic distortion analyzer-Recorders: introduction to magnetic recording techniques, strip chart recorder and x-y recorders and their applications

TEXT BOOKS

Cooper W.D &Hlefrick A.D, Electronic instrumentation & measurement technique, 3rd Edition, PHI, 1991.

REFERENCES

1. Alan S Morries, "Principles of Measurement and Instrumentation", Prentice-Hall of India, 2nd Edition, 2002.
2. A.K.Sawhney, A Course in Electrical and Electronics Measurements andInstrumentation, Dhanpat Rai and sons, New Delhi, 1995.
3. H.S.Kalsi, Electronic Instrumentation, TMH, 2002

L	T	P	Cr.
3	-	-	3

B.Tech. (IV Sem.) **17EI04 - INDUSTRIAL INSTRUMENTATION**

Pre-requisites : Transducers

Course Educational Objective : In this course, student will learn about the measurement of linear and angular dimensions. Various methods of measurement for velocity, accelerate, force, torque, pressure, flow, Viscosity, humidity and liquid level

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

CO1: Identify type of transducer to measure velocity, acceleration, force, torque, pressure, flow and temperature.

CO2: Select suitable transducer to measure velocity, acceleration, force, torque, pressure, flow and temperature .

CO3: Compare mechanical and electrical type of transducers to measure process variable like velocity , acceleration, force, pressure , flow and Temperature.

UNIT – I:DISPLACEMENT, VELOCITY, ACCELERATION AND VIBRATION MEASUREMENT

LVDT,RVDT, Relative velocity – Translational and Rotational velocity measurement – Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods – LVDT accelerometer, piezoelectric accelerometer, seismic transducer.

UNIT – II :FORCE AND TORQUE MEASUREMENT

Force measurement: Mechanical and electrical methods-Torque measurement – Dynamometers.

UNIT – III :PRESSURE MEASUREMENT

Basics of Pressure measurement :Mechanical and electrical methods– Deadweight tester and Manometers types –Low Pressure measurement – McLeod Gage, Knudsen Gage, Thermal Conductivity Gages, Ionization Gazes.

UNIT – IV :FLOW MEASUREMENT

Head type, Area type (Rota meter)- differential pressure ,turbine flow ,open channel flow meter-electromagnetic type, Positive displacement type, mass flow meter, ultrasonic type ,vertex shedding type, Hotwire anemometer type. Laser Doppler Velocity meter.

UNIT – V :TEMPERATURE & OTHER MEASUREMENTS

Thermometer , Thermocouples, Thermopiles, Thermistors, Resistance temperature detector (RTD), Bimetallic strip, Bolometer, Pyrometer, IC sensors

Other measurements: viscosity, level, pH value.

TEXT BOOKS

A.K.Sawhney,"A course in Mechanical Measurements & Control", Dhanpat Rai and Co (LTD), 2012.

REFERENCES

1. D. Patranabis, "Principles of Industrial Instrumentation", TMH, 3rd Edn: 2010
2. B. C. Nakra, K. K. Chaudhry "Instrumentation, Measurement And Analysis" 2nd Edition 2002, Tata Mcgraw Hill Publishers
3. R.K.Jain,"Mechanical& Industrial Measurements", Khanna Publishers -1986.
4. Jones E.B.,"Instrument Technology",Vol-1,1974

B.Tech. (IV 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. (IV 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	1

B.Tech. (IV Sem.) 17ME77 - ENGINEERING FLUID MECHANICS LAB

Pre-requisites :

Course Educational Objective: In this course student will learn about to learn the insights of estimating the discharge in various flow measuring devices, performance parameters of pumps and turbines.

Course Outcomes: After completion of the course students are able to:

CO1: Formulate law of conservation energy to steady, inviscid and incompressible flows through validation

CO2: Calibrate venture meter and orifice meter.

CO3: Analyze forces due to impact of jets on vanes by impulse-momentum theorm and types of flows by Reynold's experiment

CO4: Evaluate performance of general hydraulic machines, Flow and pressure measurement and devices

LIST OF EXPERIMENTS

At least 10 Experiments are required to be conducted

1. Verification of Bernoulli's Theorem
2. Calibration of Venturi meter
3. Calibration of Orifice meter.
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
9. Performance Test on Single Stage Centrifugal Pump.
10. Performance Test on Reciprocating Pump.
11. Turbine flow meter.
12. Reynolds experiment.
14. Flow Visualization study using Water Flow Channel

REFERENCES Lab Manuals

B.Tech. (IV 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. (IV Sem.)	17EI61 - ELECTRICAL AND ELECTRONICS MEASUREMENTS LAB	L	T	P	Cr.
		-	-	2	1

Pre-requisites: Applied Physics & EDC Lab

Course Educational Objective : In this course, student will learn about the measurement of Q factor with Q meter. DC & AC meters using D'Arsonaval Galvanometers. Works with various types of sensors/Transducers, AC & DC bridges.

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

CO1: Analyze the D'Arsonaval Galvanometer to function as DC,AC meters
CO2: Measureresistance, inductance, capacitance using q meter
CO3: Measure passive component values like low resistance, inductance, capacitance using Kelvin double bridge, Maxwell's bridge, hay's bridge and schering bridge
CO4: Measure frequency and phase using Wien's bridge, Lissajous Patterns

LIST OF EXPERIMENTS:

1. Conversion of D'Arsonval Galvanometer into D C meters.
2. Conversion of D'Arsonval Galvanometer into A C meters.
3. Conversion of D'Arsonval Galvanometer into Ohm- meter.
4. Q-factor measurement.
5. Measurement of Inductance using Maxwell's Bridge.
6. Measurement of Capacitance using Schering Bridge.
7. Measurement of Inductance using Hay's Bridge.
8. Measurement of frequency using wien bridge.
9. Measurement of low resistance uising Kelvin double bridge.
10. Measurement of Frequency using Lissajious Patterns.
11. Measurement of Phase using Lissajous Patterns.
12. Measurement of Resistance using Wheatstone bridge

NOTE: Minimum 10 experiments can do in above mentioned experiments

B.Tech. (IV 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. (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.)	17EI05 - COMMUNICATION SYSTEMS	L	T	P	Cr.
		3	-	-	3

PREREQUISITE: Differential Equations and Linear algebra, Signals and Systems

COURSE EDUCATIONAL OBJECTIVE (CEO):

In this Course student will learn about the basic concepts of analog & digital modulation techniques and compare performance characteristics of various linear modulation systems.

COURSE OUTCOMES (COs): After completion of the course, the student will be able to:

CO1: Interpret the basic concepts of analog and digital modulation techniques.

CO2: Differentiate analog and digital modulation and demodulation techniques

CO3: Calculate the parameters like modulation index, bandwidth, side band frequencies related to analog modulation techniques.

CO4: Compare digital communication to analog communication through the concepts of PCM, DPCM, DM & ADM.

UNIT I:

LINEAR MODULATION

Introduction to Electrical Communication System, Need for modulation, Classification of modulation schemes, Amplitude modulation: Definition, time domain and frequency domain representation, Single tone amplitude modulation, modulation index, power relations in AM waves, Generation of AM waves: Square law modulation, Envelope Detection of AM waves. Double side band suppressed carrier modulation (DSBSC): Definition, time domain and frequency domain representation, Generation of DSBSC waves: Balanced modulator, Coherent detection of DSBSC waves, Limitations of Coherent detection: Frequency error, Phase Error, Costas receiver, Single side band (SSB) Modulation: Definition, Generation of SSB waves: phase discrimination method, Coherent detection of SSB waves, Frequency division multiplexing (FDM).

UNIT – II:

ANGLE MODULATION

Definition, types of angle modulation: Frequency modulation, Phase modulation, single tone frequency modulation, Narrow band FM(NBFM):time and frequency domain representation, Wide band FM(WBFM):time and frequency domain representation, Transmission bandwidth of FM , Generation of FM : direct method, indirect method. Detection of FM waves: Frequency discrimination method, Phase discrimination method.

UNIT – III:

PULSE MODULATION

Pulse modulation: sampling theorem types of pulse modulation, Pulse amplitude modulation (PAM): definition, generation of PAM waves: Ideal, natural and flat top sampling. Demodulation of PAM waves, Pulse width modulation (PWM):Definition, generation of PWM, Demodulation of PWM waves, Pulse position modulation(PPM) :Definition , generation of PPM, Demodulation of PPM , Time division multiplexing (TDM). Noise: Definition, classification of Noise, Internal noise and external noise.

UNIT – IV:
DIGITAL MODULATION
Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, DPSK, Comparison of various digital modulations.

UNIT – V:
PULSE DIGITAL MODULATION
Advantages of digital communication over analog communication, Quantization, Pulse Code Modulation system, bandwidth of PCM, Differential PCM, Delta Modulation, drawbacks of delta modulation, Adaptive delta modulation

TEXT BOOKS
1. Simon Haykin, "Communication Systems",Second Edition, John Wiley & Sons Publications", Singapore, 1983.
2. Sanjay Sharma, "Communication systems (Analog and Digital)", Fifth Revised Edition, S.K.Kataria& Sons, New Delhi, 2010

REFERENCES
1. R.P.Singh, S.D.Sapre,"Communication Systems (Analog & Digital)", Second Edition, Tata McGraw-Hill Publications, 2009.
2. Herbert Taub , Donald L. Schilling, "Principles of Communication Systems", Second Edition, Tata McGraw-Hill, New Delhi, 1991.
3. Hwei, P. Hsu, "Analog and Digital Communications", Schaum's Outlines, Second Edition, TMH Publiscations,1991.
4. B.P.Lathi, "Modern Digital and Analog Communication Systems", Third Edition, Oxford University,1993**.**

B.Tech. (V 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. (V Sem.)	17EI06 - INTEGRATED CIRCUITS AND APPLICATIONS	L	T	P	Cr.
		3	-	-	3

Prerequisite -Electronic Devices and Circuits, Analog Electronic Circuits

Course Educational Objective (CEO): In this course students will learn about the characteristics and features of OP-amp, Applications of Op-amp, applications of 555 timer, functional diagram of PLL, applications of PLL, Classification of filters, generators, converters. Comparison of logic families and design of combinational circuits using 74xx series, and sequential circuits. ROM, RAM architecture, timing diagrams and types.

COURSE OUTCOMES (COs):After completion of the course, students will be able to

CO1: Interpret the ideal and practical Op-amp, different types of filters, logic families, combinational circuits, sequential circuits and memories
CO2: Utilize the applications of op-amps..
CO3: Apply the basics of op-amp to differentiate A/D and D/A converters and PLL.
CO4: Analyze different TTL, CMOS logic families in the design of combinational circuits.
CO5: Classify and discuss counters, RAM and ROM.

UNIT – I OPERATIONAL AMPLIFIER:

Basic information of Op-amp, ideal and practical Op-amp circuits, Op-amp DC and AC characteristics, Basic applications of op-amp- Adder, Subtractor, Adder-Subtractor, instrumentation amplifier, V to I and I to V converters, sample & Hold circuits, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrators.

UNIT – II ACTIVE FILTERS & OSCILLATORS:

Introduction, 1st order LPF, HPF filters. Band pass, Band reject and all pass filters. Oscillator types and principle of operation - RC, Wien bridge, waveform generators- triangular, saw tooth, square wave.

UNIT – III TIMERS:

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, PLL-introduction, block schematic, principles and description of individual blocks of 565, applications of PLL, VCO.

CONVERTERS: weighted resistor DAC, R-2R ladder DAC, different types of ADCs – parallel comparator type ADC, counter type ADC, DAC and ADC specifications.

UNIT – IV LOGIC FAMILIES & COMBINATIONAL CIRCUITS:

Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate, TTL open collector O/Ps, Tristate TTL, CMOS open drain and tristate outputs. Design using TTL-74XX series, decoders, Demultiplexers, priority Encoder, multiplexers, Digital comparator circuits.

UNIT – V SEQUENTIAL CIRCUITS & MEMORIES:

74XX series of IC counters, ROM architecture, RAM architecture, Static& Dynamic RAMs.

TEXT BOOKS

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (p) Ltd, 2nd Ed., 2003.
2. Floyd and Jain, "Digital fundamentals", Pearson Education, 8th Edition, 2005.

REFERENCES

1. R.F. Coughlin and Fredrick F. Driscoll, "Operational Amplifiers and Linear Integrated circuits", PHI, 1977.
2. Denton J. Daibey, "Operational Amplifiers and Linear Integrated circuits: Theory and Applications", TMH, 2001.
3. Serigo Franco, "Design with Operational amplifiers an Analog Integrated Circuits", McGraw Hill, 3rd Ed., 2002.
4. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", PHI 2nd Edition, 2000.
5. Ramakanth A. Gayakwad, "Op-Amp & Linear ICs", PHI, 1987.

B.Tech. (V Sem.) **17EI07 - CONTROL SYSTEMS ENGINEERING**

L	T	P	Cr.
3	-	-	3

PREREQUISITE: Differential Equations and Linear Algebra

COURSE EDUCATIONAL OBJECTIVE (CEO): In this course students will learn about the concepts of controls systems to any process parameters which can be used in industries.

COURSE OUTCOMES (CO):After the completion of the course, students will be able to,

CO1: Identify basic elements of open loop and closed loop control systems and alsoderive systems input output relations using differential equation (from physical systems) BDR & signal-flow graphs techniques.

CO2: Analyze the response of a system in Time Domain with various test signals.

CO3: Evaluate the quantitative response of a system in Frequency Domain with test Stimuli.

CO4: Analyze and characterize the stability of system by RHC, Root Locus, Bode Plot, Polar Plot etc.

CO5: Apply the concepts of State Space Model for MIMO

UNIT – I

INTRODUCTION-MATHEMATICAL MODELLING OF CONTROL SYSTEM

Concepts of Control Systems- Classification of control systems, Open Loop and closed loop control systems – examples-Feed-Back Characteristics, Effects of feedback.

Mathematical models – obtain transfer function for a Translational and Rotational mechanical systems, and derivation of transfer function using Force (Torque)-Voltage, Force (Torque)-Current analogies.

Block diagram representation-Block diagram algebra, reduction of block diagrams, Calculation of transfer function,**Signal flow graph** - Reduction using Mason's gain formula

UNIT – II

TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems and second order systems for step input signal - Time domain specifications – Steady state response - Steady state error constants.

UNIT – III

FREQUENCY RESPONSE ANALYSIS

Frequency domain specifications, Polar Plots, Bode diagrams-Phase margin and Gain margin.

UNIT –IV

STABILITY ANALYSIS & COMPENSATORS

The concept of stability – R-H stability-The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci- Compensation techniques – Lag, Lead, Lead-Lag Compensator design in frequency Domain only.

UNIT – V STATE SPACE ANALYSIS

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- state Transition Matrix and it's Properties, Concepts of Controllability and Observability.

TEXT BOOKS

1. B. C. Kuo , "Automatic Control Systems" John wiley and sons, 8th edition, 2003.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited Publishers,2nd edition,2002.

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, 2007
3. Richard C Dorf, Robert H Bishop, "Modern control systems", 8th edition, Prentice Hall(Pea rson education, Inc.), New Delhi 2003.
4. Benzamin C. Kuo and FaridGolnaraghi," Automatic Control Systems", 8th Edition, John Wiley, New Delhi, 2003.

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.)	17EI08 - INDUSTRIAL ELECTRONICS	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITE - Electronic Devices and Circuits, Transducers

COURSE EDUCATIONAL OBJECTIVE (CEO):

In this course students will learn about the industrial used amplifying circuits and their characteristics of thyristor family along with the regulation of Power supplies and the protection techniques.

COURSE OUTCOME (COs): At the end of the course, the students will able to:

CO1: Analyze the different types of amplifying circuits and their characteristics.
CO2: Design various types of regulated power supplies.
CO3: Discuss about the principles and methods of turn ON/OFF mechanism and triggering of SCRs.
CO4: Analyze the industrial timers and electrical weldings which can be used in industrial applications.
CO5**:** Compare various of heating techniques in industrial applications.

UNIT - I

DC AMPLIFIERS: Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT - II

REGULATED POWER SUPPLIES: Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.

UNIT - III

SCR AND THYRISTOR: Principle of operation and characteristics of SCR, Methods of Turn on and turn off mechanism, Gate characteristics, Ratings of SCR -Triggering of SCR, Diac and Triac Phase controlled half and full wave rectification.

UNIT - IV

INDUSTRIAL APPLICATIONS – I : Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.

UNIT - V

INDUSTRIAL APPLICATIONS – II : High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications.

TEXT BOOK

GK Mithal&DrManeesha Gupta, "Industrial & Power Electronics", 19th Edn., Kanna Publications, 2003

REFERENCES

1. J. Millman and C.C Halkias , "Integrated Electronics", McGraw Hill, 1972.
2. Theodore.H.Bogart, "Electronic Devices and circuits", Pearson Education,6th Edn., 2003.
3. M. Rammurthy, "Thyristors and applications", East-West Press, 1977.

B.Tech. (V Sem.)	17EI09 - INTELLIGENT INSTRUMENTATION	L	T	P	Cr.
		3	-	-	3

Prerequisite: Transducers, Process control Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course students will learn about the intelligent instrumentation system, linearization, calibration and compensation methods of intelligent sensors and their standards, protocols.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:

CO1: Classify intelligent sensors in toself generating, variable parameter, radio-active, semiconductor, array based and biosensor.

CO2: Summarize the concepts of artificial intelligence and fuzzy logic for intelligent sensors.

CO3: Discuss linearization, calibration and compensation of intelligent sensors.

CO4: Apply the concepts of intelligent sensors with respect to adaptive, validation and their temperatures compensation towards an instrumentation system.

CO5: Categorize the sensor standards and protocols for intelligent instrumentationsystem.

UNIT - I INTRODUCTION:

Introduction, Process, Process parameters, Classical Sensors and Transducers-Classification, Self generating transducers, variable parameter transducers, radio-active transducers, semiconductor sensors, array based sensors, biosensors and actuating devices.

UNIT - II INTELLIGENT SENSORS:

Cogent sensors, virtual sensors, self-adaptive sensors, self-validate sensors, Temperature compensating intelligent sensor

UNIT – III LINEARIZATION, CALIBRATION AND COMPENSATION:

Analog Linearization of positive coefficient resistive sensors-linearization by shunt resistance, positive feedback OPAMP circuit (current source, voltage source) .Microcontroller based linearization, Sensor Calibration-conventional calibration circuits, resistor adjustment-based analog calibration, offset calibration, offset compensation, error and drift compensation

UNIT – IV SENSORS WITH ARTIFICIAL INTELLIGENCE:

Introduction to Artificial Intelligence sensors: sensors with Artificial Intelligence, multidimensional intelligent sensors. ANN based intelligent sensors: Linearization and calibration by ANN, compensation error by ANN, soft sensing by ANN, fault detection by ANN, Fuzzy Logic based Intelligent sensors

UNIT – V INTELLIGENT SENSOR STANDARDS AND PROTOCOLS:

Introduction-IEEE 1451 standard-Network Technologies-LonTalk-CEBUS communication Protocol for smart home-J1850 Bus-M1 Bus-Plug-n-Play Smart Sensors.

TEXTBOOK

1. ManabendraBhuyan, “Intelligent Instrumentation: Principles and Applications”, CRCpress,2011
2. Barney G C,“Intelligent Instruments. HemelHempstaeo”: Prentice Hall, 1985.

REFERENCES

1. J.B. Dixit Amit, “Intelligent Instrumentation for Engineers”, University science press, 2010
2. A.S. Morris, “Principles of measurement and Instrumentation”, Prentice Hall, 1993.

B.Tech. (V Sem.)	17IT81 - COMPUTER NETWORKS	L	T	P	Cr.
		3	-	-	3

Pre-requisites **:** Data communication

Course Educational Objective:

The Students will be able to learn the concepts, vocabulary and techniques currently used in the area of computer network, study protocols, network standards, the OSI model, IP addressing, cabling, networking components, and basic LAN design, accumulate existing state-of-the-art in network protocols, architectures, and applications, familiar with contemporary issues in networking technologies .

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

CO1: Observe the concepts of various network architectures, physical media, and channel access techniques.

CO2: Interpret Data Link Layer and medium access protocols for direct link networks.

CO3:Analyse and implement internetworking and Routing Algorithms.

CO4: Visualize Adaptive Flow control, Adaptive retransmission and congestion avoidance mechanisms in TCP.

CO5:Examine various applications like e-mail, DNS, SNMP, and PGP.

UNIT - I

Introduction: Use of Computer Networks- Network Hardware- Network software-Reference models Example Networks- Network Standardization. Physical Layer: The theoretical basis for Data communication- Guided Transmission Media.

UNIT - II

Data link layer: design issues- framing, error detection and correction, CRC, Elementary data link protocols- Simplex, Stop&Wait protocols, Sliding window protocols-one-bit,go-backn,selective repeat. Medium Access Control Sub layer: Channel allocation problem- multiple access protocols-ALOHA, CSMA protocols, token bus,token ring, Ethernet, Collision free protocols, Data link layer switching, Bridges, Local internetworking, Overview of Two DLC Protocols: HDLC, PPP.

UNIT – III

Network layer: Network layer design issues- Routing algorithms- Shortest path, Flooding, Distance vector routing, Link State routing , Hierarchical Routing, Broadcast routing & Multicast Routing,ICMP,ARP,RARP, IPv4 Datagram Format, IPV4 Addresses notation , Classful Addressing, Classless Addressing,, Congestion control algorithms- Leaky Bucket, Token Bucket, Quality of service.

UNIT - IV

Transport layer: Transport service- Elements of transport protocols- Internet transport protocols: TCP & UDP, Flow control-Segments, TCP Timers.

UNIT - V

Application Layer: Domain Name System- Electronic Mail -the World Wide Web, Simple Network Management Protocol (SNMP), Multimedia, Network Security Standards.

TEXT BOOKS

1. Andrews S. Tanenbaum, "Computer Networks", PHI, Fourth Edition.
2. Computer Networks: A Top –Down Approach, Behrouz A. Forouzan and Firouz, Mosharraf,2012 , Tata McGraw Hill.

REFERENCES

1. William Stallings, "Data and Computer Communications", Pearson Education, seventh Edition.
2. James F.Kurose, Keith W.ROSS, "Computer Networking a Top-Down Approach featuring the Internet", Pearson Education.

B.Tech. (V 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)

1. Interfacing ADC
2. Interfacing DAC .
3. Interfacing stepper motor.
4. Interfacing 7-segment display.
5. Interfacing keyboard.
6. Interfacing serial/parallel Printer.

B.Tech. (V Sem.)	17EI62 - INTEGRATED CIRCUITS AND APPLICATIONS LAB	L	T	P	Cr.
		-	-	2	1

Course Educational Objective (CEO):In this lab Course student will learn about Various linear IC applications as Adder, Subtractor, Comparator, filters, 555 timer and its applications, voltage regulators and design of DAC using Op-amp.Design of shift registers, comparators, decoders, multiplexers, demultiplexers using VHDL programming.

Course Outcomes (COs): After completion of course, students will be able to

CO1: Demonstrate various linear IC applications as Adder, Subtractor, Comparator, Active filters, Oscillators, Function generator.
CO2: Design D to A Converters using Op-Amp.
CO3: Design monostable and astable circuits using 555 timer.
CO4: Synthesize decoders, multiplexers, shift registers, comparators using xilinx software.

LIST OF EXPERIMENTS

1. Op-Amp Applications-Adder, Sub tractor, Comparator Circuits
2. Active Filter Applications-LPF,HPF(First Order)
3. Function Generator Using Op-Amps.
4. Using IC 555 Timer design Monostable Operation Circuit.
5. Using IC 555 Timer design Astable Operation Circuit.
6. Three Bit R-2R DAC Using Op-Amp.
7. 1x4 De Multiplexer 74x155
8. D-Flip Flop 74x74
9. Decade Counter-74x90
10. Shift Register-74x95
11. 4-Bit Magnitude Comparator 74x85
12. 8x1 Multiplexer 74151

Note: Minimum 10 Experiments can be done in the above list

B.Tech. (V Sem.)	17EI90 - SAFETY INSTRUMENTATION (*Add on course – I)	L	T	P	Cr.
		3	-	-	3

Prerequisite: Transducers, Industrial Instrumentation

Course Educational Objective (CEO) :In this course students will learn about the importance of safety instrumentation by following standard procedures and also the various hazards and accidents occurring in Industry.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:

CO1: Identify various types of hazards in industry.
CO2: Summarize the various hazards associated with heat and light.
CO3: Analyze the impact of vibration and bad ventilation on human health.
CO4: Select appropriate personal protective equipment and first aid inside the industry while working.

UNIT – I INDUSTRIAL ACCIDENTS:
Introduction, types of accidents, nature/effect of accidents, cause, prevention, typical accident in industry, classification of hazards, major industrial hazards.

UNIT – II ENVIRONMENTAL FACTORS IN INDUSTRY:
Environment, need for environmental control, environmental factors in industry, effect of environmental factor on human body and mind.

UNIT – III LIGHTING AND HEAT HAZARDS:
Lighting-artificial light, source of artificial lighting, recommended illumination value of industrial building and process, Heat control-thermal exchange of body with environment, factors to heat stress, removal of heat from body, heat stress disorder, preventing heat stress, thermal comfort, factor affecting thermal comfort, condition for thermal comfort, thermal discomfort.

UNIT – IV VENTILATION AND VIBRATION HAZARDS:
Purpose of ventilation, health effect, general ventilation, method, sources, air cleaning, air conditioning, types, room AC, central AC, vibration, effect on health, source, vibration exposure, whole body vibration, hand-arm vibration, prevention.

UNIT – V PERSONAL PROTECTIVE EQUIPMENT AND HEALTH PROBLEMS:
introduction, need for personal protective equipment, assessing suitable PPE, choice and use of PPE, types of PPE, non-respiratory protective equipment, respiratory protective equipment, occupational disease, first Aid.

TEXT BOOKS
Amir kumarguptha, “Industrial safety and environment”, LP publication, 2006

REFERENCES
Dave Macdonald, “Practical Industrial Safety, Risk Assessment and Shutdown Systems”, Newns,Elsevier, 2004

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.) 17EI10 - PROCESS CONTROL INSTRUMENTATION	L	T	P	Cr.
	2	2	-	3

PREREQUISITE: Transducers, Control systems Engineering,

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course student will learn about fundamentals of process dynamics, types of control actions and controllers, determining controller settings by suitable tuning methods, the operation of various types of control valves, and various advanced control techniques.

COURSE OUTCOMES (COs):At the end of this course, students will be able to

CO1: Define process, elements of process control, process variables, dynamics of processes (liquid, pressure, flow and thermal processes), selfregulation, dead time, tuning of controllers and control valves.

CO2: Summarize basic control actions (On-off, P, I, D, PI, PD, PID modes), advanced control schemes (cascade control, feed forward control, split range control and multivariable control) and different types of controllers (pneumatic, hydraulic and electronic).

CO3: Analyze time integral performance criteria (ISE, IAE, ITAE), 1/4 decay ratio and controller tuning methods (process reaction curve method, continuous oscillation method and damped oscillation method)

CO4: Classify control valves (globe, butterfly, diaphragm type and ball valves) and actuators (pneumatic, hydraulic and electric) .

CO5: Determine transfer function of different types of processes,response of controllers for different test inputs, optimum controller settings from given data and suitable control valve size for given application.

UNIT – I

PROCESS CHARACTERISTICS:

Process variables—Process Degree of Freedom -Dynamics of simple pressure, flow, level and temperature process - Interacting and Non interacting systems-continuous and batch process-self regulation, Dead-time,P&ID symbols and Diagrams .

UNIT – II

CONTROLLER CHARACTERISTICS:

Basic control actions- characteristics of two position, three position, single speed and multiple speed floating, proportional, integral and derivative control modes, PI, PD, PID control modes-problems, Pneumatic, Hydraulic, Electric and Electronic controllers to realize various Control actions.

UNIT – III

CONTROLLER SETTINGS AND TUNING:

Evaluation criteria- 1/4th decay ratio, IAE, ISE, ITAE- Determination of optimum settings for process using Tuning methods – process reaction curve method- continuous oscillation method-damped oscillation method -problems.

UNIT – IV

FINAL CONTROL ELEMENTS

I to P converter, P to I converter - Pneumatic, Electric and Hydraulic Actuators-Fluid flow through Control valves- Sliding-Stem Control valves- Plug valves, Gate valve, Weir valve–- Rotating-Shaft Control valves – Rotating-Plug valves, Butterfly valves, Louvers - Control valve characteristics -Control valve sizing- problems.

UNIT – V

ADVANCED CONTROL STRATEGIES:

Cascade control, Feed forward control, Ratio control, Split-Range control, and Override control.

TEXT BOOKS

1. Donald P. Eckman, "Automatic process control", Wiley India, 2009.
2. Peter Harriott,"Process control", TMH Publishers, 2012.

REFERENCES

1. George Stephanopoulos, "Chemical process control – An Introduction to Theory and Practice", PHI, New Delhi, 1999.
2. Curtis D. Johnson, "Process Control Instrumentation Technology", PHI,

B.Tech. (VI Sem.) **17EI11 - BIO MEDICAL INSTRUMENTATION**

L	T	P	Cr.
2	2	-	3

Prerequisite: Transducers, Industrial Instrumentation

Course Educational Objective (CEO) :In this course student will learn about medical instrumentation system, different types of electrodes used in bio-potential recording,Instrumentation concerned with measuring blood pressure, blood flow, respiratory system, Therapeutic, Prosthetic devices , Clinical laboratory instruments, Medical imaging systems and patient safety.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:

CO1: Classify electrodes used in bio-potential recording and Illustrate medical instrumentation system.
CO2: Discuss the Physiology and instrumentation concerned with respiratory system
CO3: Analyze the Patient Safety and Medical Imaging Systems.
CO4: Evaluate the performance of Pacemakers and different Spectrometers.
CO5: Measure bio electric potentials generated by Cardiovascular, nervous systems, blood pressure and blood flow by using various methods & techniques.

UNIT – IMEDICAL INSTRUMENTATION SYSTEM&ELECTRODES:
Generalized Medical instrumentation system, Problems encountered with measurements from Human beings, Cell structure, Action & Resting potentials. Bio-potential electrodes, Bio chemical electrodes, Internal Electrodes.

UNIT – II PHYSIOLOGY OF CARDIOVASCULAR,NERVOUS SYSTEMS:
Electro Cardiography–The Heart and Cardiovascular System, Cardiac Cycle, Einthoven triangle (12-Lead configuration), **Electro-Encephalography**-,Block Diagram of EEG ,The Brain Description of ElectroEncephalograph, Typical Resting Rhythms . **Electromyography:** Block Diagram of typical setup for EMG.

UNIT – IIIMEASUREMENT OF BLOOD PRESSURE,BLOOD FLOW & RESPIRATORY SYSTEM:
Blood Pressure: Direct and Indirect measuring techniques of BP.Blood Flow: Electro Magnetic, Doppler and dilution methods. Physiology of the Respiratory System, Mechanics of Breathing, Spirometry, Respiratory Therapy Equipment-Ventilators, Humidifiers and Nebulizers.

UNIT – IV THERAPEUTIC ,PROSTHETIC DEVICES AND CLINICAL LABORATORY INSTRUMENTS:
Therapeutic ,Prosthetic Devices: Pacemakers, Defibrillator, Short wave Diathermy
Clinical laboratory Instruments: Spectrophotometers, Flame photometer.

UNIT – V MEDICAL IMAGING SYSTEMS AND PATIENT SAFETY:
Medical Imaging Systems: Computed Tomography, Magnetic Resonance Imaging System
Patient Safety: Physiological effects of Electrical Current, Electric shock Hazards, Electrical safety analyzer.

TEXT BOOKS

1. Leslie Cromwell, Fred j. Weibell, Erich a. Pfeiffer, "Bio medical instrumentation & Measurements", PHI publishers, 2nd edition,2001.
2. R.S.Khandpur , "HandBook of BioMedical Instrumentation", TMH, New Delhi,2003.

REFERENCES

1. Dr.M.Arumugam, "Bio medical instrumentation" Anuradha Agencies publishers,2003.
2. John G.Webster, editor john wiley, "Medical instrumentation application & design", 3rd edition,2009
3. L.A.Geddes and L.E.Baker, "Principles of Applied Bio-Medical Instrumentation", John Wiley &Sons Inc,1975.

B.Tech. (VI 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-IIZ 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. (VI Sem.)	17EI12 - OPTO ELECTRONICS AND LASER INSTRUMENTATION	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITE: Applied Physics, Materials Science and Engineering, Electronic Devices and Circuits

COURSE EDUCATIONAL OBJECTIVE(CEO):

In this course, student will learn about the basic concepts, construction & working details of optical fibers, lasers and fiber based sensors including industrial and medical real time applications.

COURSE OUTCOMES(COS):At the end of this course, student will be able to

CO1: Interpretthe construction and working principles of optical fibers and lasers.

CO2: Classify fiber optic sensors for measurement of temperature, pressure, current, voltage, liquid level.

CO3: Illustratethe optical concepts for making holograms, properties of hologram and applications.

CO4: Analyze the necessity of lasers and optical fibers suits for medical and industrial applications.

CO5: Apply the opto electronic devices in Bio-medical applications.

UNIT – I

OPTICAL FIBERS AND THEIR PROPERTIES

Introduction, Structure of Fibers, Propagation of Light in the Fiber, Fiber Specification, Types of Fibers: Step Index Fiber, Graded Index Fiber, Multimode and Single mode Fibers, Optical Fiber Cables, **Attenuation in Fiber Optics**: Intrinsic Attenuation, Extrinsic Attenuation, Fiber Bending, Dispersion, Bandwidth, **Optical Fiber Connection**: Joints and Couplers, Fiber Splices, Connector Basics.

UNIT – II

LASERS

Introduction, Laser Characteristics, Amplification of Light, Population Inversion, Energizing the Amplifying Medium, Laser Oscillator, Quantum Properties of Light, Emission and Absorption Coefficients, The Einstein Coefficients, Oscillator Strengths, Three-level system, **Gas Lasers**: Helium-Neon Laser, Argon ion(Ar+)gas laser, Carbon dioxide laser, **Solid State Lasers**: The Ruby Laser, Nd: YAG laser, Q-Switching, Mode Locking.

UNIT – III

FIBER OPTIC SENSORS AND OPTICAL DETECTORS

Wavelength Modulated Sensors: Displacement Sensor, Temperature Sensor, **Interfero-metricSensors:** Fiber Optic Interferometers, Magnetic Fields/Electric Current Sensor, Electric Field/Voltage Sensor, Gyroscope, Liquid Level Sensors, **Polarimetric Sensors**: Faraday effect, Kerr effect, Electric current Sensor, Magnetic Field Sensor, **Fiber Bragg Grating Based Sensors**: Sensing Principles, Strain Sensor.

UNIT – IV

LASER INSTRUMENTATION& HOLOGRAPHY

Industrial Applications of Lasers: Laser Doppler Velocity Meter, Lasers Cooling, Optical Tweezers, Military Applications, **Holography**: Introduction, Coherence of Light, Coherence of Length, Principle of Holography, Advantages of Holography, Fresnel zone Plate, Practical Holography, Properties of Holograms, Types of Holograms, and Applications.

UNIT – V

MEDICAL APPLICATIONS OF LASERS

Medical Surgery Fields: The Effects of the Laser Beam on the Biological Tissue, Laser Surgery and Advantages, Cosmetic Surgery, General Surgery, Ophthalmology, Oncology, Dermatology, Dentistry, Low Power Laser Applications.

TEXT BOOKS

1. P. Sarah, "Lasers and Optical Fibre Communications", I.K. International Publishing House Pvt Ltd., New Delhi, 2008.
2. B. D. Gupta, "FiberOptic Sensors Principles and Applications", New India Publishing Agency, New Delhi,2006.

REFERENCES

1. A.K. Ghatak, "Optics", Tata McGraw-Hill, New Delhi, 2nd Edition, 1992.
2. K. Thyagarajan and A.K. Ghatak, "Lasers: Theory and Application",Plenum Press, New York, 1981.
3. P. Das, "Lasers and Optical Engineering", Springers International, Students Edition, 1991.
4. A.K. Ghatak and K. Thyagarajan, "Optical Electronics", Foundation Books, 1991.
5. S.C. Gupta, "Optical Fiber Communication and its Applications",Prentice-Hall of India, 2004.

B.Tech. (VI Sem.)	17EI13 - VIRTUAL INSTRUMENTATION	L	T	P	Cr.
		3	-	-	3

PREREQUISITE: C Programming, Transducers, Process Control Instrumentation.

COURSE EDUCATIONAL OBJECTIVE(CEO):In this course, student will learn about how to build an engineering application in LABVIEW using data structures, file input output, charts, data acquisition and interfacing with standard instruments.

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

CO1: Differentiate between traditional instrumentation and virtual instrumentation.
CO2: Analyse the programming concept of virtual instrumentation.
CO3: Develop software programs using loops, formula nodes, array and clusters.
CO4: Test and troubleshoot various programs.
CO5: Evaluate process signals using different DAQ modules

UNIT - I
INTRODUCTION TO VIRTUAL INSTRUMENTATION:
History of Instrumentation. Systems, Evolution ofVirtual Instrumentation, Premature Challenges, Programming Requirements, Drawbacks ofRecent Approaches, Conventional Virtual Instrumentation, Distributed Virtual Instrumentation,Virtual Instrumentation versus Traditional Instruments, Advantages.

UNIT – II
PROGRAMMING TECHNIQUE
Virtual instrumentation-front panel, block diagram, Lab VIEW environment, data flow programming, G programming

UNIT - III
PROGRAMMING CONCEPT OF VI
VI& Sub Vis, loops, shift register, feedback node, formula node, case and sequence structures, arrays, clusters.

UNIT – IV
OUTPUT VERIFICATION TOOLS
Waveform Graphs, waveform charts, files I/O, local and global variables

UNIT – V
DATA ACQUISITION SYSTEMS
Introduction to data acquisition, Data Acquisition in Lab VIEW, Hardware Installation And Configuration, Components of DAQ,DAQ Assistant, DAQ Hardware.

TEXT BOOK
S.Sumathi,P.Surekha, "Virtual Instrumentation with Lab VIEW", ACME LEARNING PVT LTD,2007.

REFERENCES
1. JovithaJerome,"virtual instrumentation using Lab VIEW", PHI Learning PVT.LTD,2006.
2. Jeffrey Travis, jimkring,"LabVIEW for Everyone",Pearsoneducation, 2009.

L	T	P	Cr.
3	-	-	3

B.Tech. (VI Sem.) **17ME53 - INDUSTRIAL ROBOTICS**

Course Educational Objectives (CEOs): The main objective of this course is to impart knowledge on the basic concepts of industrial robotics.

Course Outcomes (COs):

At the end the student will be able to learn

CO1: Understand various robot configurations and components.
CO2: Distinguish various types of end effectors and its applications.
CO3: Comprehend various Methods of robot programming.
CO4: Select appropriate sensors for image processing.
CO5: Identify appropriate actuators as per the required application.

UNIT – I

ROBOTICS

Introduction - Basic concepts – Robot anatomy –Components of robots- Robot motions – Number of D.O.F – Work volume – Classification of robots by control method – Specifications of robots.

UNIT – II

END EFFECTORS: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups, magnetic grippers, adhesive gripers and others – Robot / End effectors interface – Considerations in gripper selection and design

UNIT – III

ROBOT PROGRAMMING

Methods of robot programming – Lead through method.-Textual robot languages – Generations of programming languages – Robot language structure – Motion commands – End-effector and sensor commands – VAL II programming language.

UNIT – IV

ROBOT SENSORS AND VISION

Feedback components: Position sensors – potentiometers, resolvers, encoders; velocity sensors-Industrial applications of vision – controlled robotic systems-process of imaging-architecture of robotic vision systems-image acquisition.

UNIT – V

ACTUATORS

Pneumatic-Hydraulic Actuators-Servo motors-Stepper motors- characteristics.

ROBOT APPLICATION

Robots in Industrial and Non-Industrial Applications –Future applications.

TEXT BOOK

1. R.K.Mittal and IJ Nagrath, Robotics and Control ,Tata Mc Graw – Hill publishing company Limited, New Delhi,2003.

REFERENCES

1. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi, 2009.
2. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi, 2004.

`

L	T	P	Cr.
3	-	-	3

B.Tech. (VI 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.

`

B.Tech. (VI Sem.)	17EI14 - OPTIMAL CONTROL	L	T	P	Cr.
		3	-	-	3

Prerequisite: Control System Engineering

COURSE EDUCATIONAL OBJECTIVE (CEO):

In this course the students will learn about numerical optimization problems, design procedure of Linear Quadratic Regulator (LQR) and also optimal control using dynamic programming.

COURSE OUTCOMES(COs):After the completion of the course, students will be able to,

CO1: Describe different types of optimal control problems such as time-optimal, fuel optimal, energy optimal control problems.

CO2: Develop the Linear Quadratic Regulator for Time – invariant and Time-varying Linear system (Continuous time and Discrete-time systems)

CO3: Interpret optimal controller using Dynamic Programming Approach and H-J-B equation.

CO4: Illustrate the pontryagin minimum principle.

CO5: Design optimal controller in the presence of state constraints and time optimal Controller.

UNIT I : CALCULUS OF VARIATIONS AND OPTIMAL CONTROL

Introduction – Performance Index- Constraints – Formal statement of optimal control system – Calculus of variations – Function, Functional, Increment, Differential and variation and optimum of function and functional – The basic variational problem Extrema of functions and functionals with conditions – variational approach to optimal control system

UNIT II : LINEAR QUADRATIC OPTIMAL CONTROL SYSTEM

Problem formulation – Finite time Linear Quadratic regulator – Infinite time LQR system: Time Varying case- Time-invariant case – Stability issues of Time invariant regulator – Linear Quadratic Tracking system: Fine time case and Infinite time case

UNIT III : DISCRETE TIME OPTIMAL CONTROL Variational calculus for Discrete time systems – Discrete time optimal control systems:-Fixed final state and open-loop optimal control and Free-final state and open-loop optimal control – Discrete time linear state regulator system – Steady state regulator system

UNIT IV : PONTRYAGIN MINIMUM PRINCIPLE

Pontryagin Minimum Principle – Dynamic Programming:- Principle of optimality, optimal control using Dynamic Programming – Optimal Control of Continuous time and Discrete-time systems – HamiltonJacobi-Bellman Equation – LQR system using H-J-B equation

UNIT V : CONSTRAINED OPTIMAL CONTROL SYSTEMS

Time optimal control systems – Fuel Optimal Control Systems- Energy Optimal Control Systems – Optimal Control Systems with State Constraints

TEXT BOOKS

1. Donald E. Kirk, "Optimal Control Theory – An Introduction", Dover Publications, Inc. Mineola, New York, 2004.
2. Frank L. Lewis, DragunaVrabie, Vassilis L. Syrmos, "Optimal Control", 3rd Edition, Wiley Publication, 2012.

REFERENCES

1. D. SubbaramNaidu,"Optimal Control Systems", CRC Press, New York, 2003.
2. B.D.O. Anderson and J.B.Moore, "Optimal Control – Linear Quadratic Methods," PHI, 1991.
3. S. H.Zak, "Systems and Control,"Oxford University Press, 2006.
4. R.T.Stefani, B.Shahian, C.J.Savant, J.G.H.Hosletter,"Design of Feedback Control Systems", Oxford University Press, 2009

B.Tech. (VI Sem.)	17EI63 - PROCESS CONTROL INSTRUMENTATION LAB	L	T	P	Cr.
		-	-	2	1

PREREQUISITE: Transducers,Control systems Engineering

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course student will learn about:
The operation and characteristics of Transmitters used in process control, controlling processvariables using basic control modes, Cascade control, working of Control valves, and controlling of DC servo motor.

COURSE OUTCOMES (COs):At the end of this course students will be able to
CO1: Determine Input-Output characteristics of different transmitters.
CO2: Examine controlling of process variables and DC servo motor using different control modes.
CO3: Demonstrate working of I to P, P to I Converters, Control valves and Process control simulator.

List of Experiments

1. Flow control.
2. Level Control.
3. Temperature Control.
4. Pressure Control.
5. I to P Converter.
6. Control valve (Quick opening & Linear) Characteristics.
7. P to I converter.
8. Process control Simulator.
9. D C Servo motor controller.
10. Cascade control.
11. Temperature Transmitter.
12. Flow Transmitter.
13. Level Transmitter.
14. Pressure Transmitter.

Note: Minimum 10 experiments to be conducted from the above list.

`

L	T	P	Cr.
-	-	2	1

B.Tech. (VI Sem.) **17EI64 - OPTICAL AND BMI LAB**

Prerequisite: Applied Physics, Transducers

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course students will learn about characteristics of Optoelectronic Components, Measurement of physiological parameters of Human body and development of Fibre Optic Communication System.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:

CO1: Evaluate the characteristics of Optoelectronic Components.

CO2: Measure Physiological parameters of Human body.

CO3: Develop Fibre optic Communication system using Analog and Digital Link.

LIST OF EXPERIMENTS:

1. Measurement of Numerical Aperture, Acceptance angle, Losses of Optical Fibre.
2. Characteristics of PIN diode.
3. Characteristics of LASER diode.
4. Setup of Fibre optic Analog link.
5. Setup of Fibreoptic Digital link.
6. Measurement of Blood Pressure.
7. Study of all the Standard ECG 12 Lead Configurations.
8. Study of measurement of normal Heart-Rate using 12 Lead ECG Simulator.
9. Study of Normal EMG waveform generated by built-in EMG Simulator.
10. Study of EEG waveforms in Unipolar ,Average recording modes.
11. Study of Bradycardia, Tachycardia using Pacemaker Simulator.

Note : Minimum 10 Experiments can be conducted from the above list

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.)	17EI91 - REMOTE SENSING (*Add on course – II)	L	T	P	Cr.
		3	-	-	3

COURSE EDUCATIONAL OBJECTIVE(CEO):In this course student will learn about-
concepts and applications leading to modelling of earth resources management using Remote Sensing and acquire skills in sensing, data acquisition and analyzing the remote sensing data.

COURSE OUTCOMES (CO):At the end of the course, the student will able to:
CO1:Define the Principles of Remote Sensing
CO2:Classify the type of remote sensing technique / data for required purpose
CO3:Identify the earth surface features from satellite images
CO4:Analyze the energy interactions in the atmosphere and earth surface features
CO5:Develop the working mechanism and applications of active and passive microwave systems.

UNIT-I BASICS OF REMOTE SENSING
Definition of Remote sensing, Principles of Remote Sensing, Sources of Energy, Active and Passive Radiation, Electromagnetic Radiation - Reflectance, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, Atmospheric windows, Spectral reflectance of Earth's surface features, Multi concept of Remote Sensing.

UNIT-II
SENSORS: Types and classification of sensors, imaging modes, Characteristicsof optical sensors, sensor resolution-spectral, radiometric and temporal, Characteristics of detectors. Data Acquisition Platforms: Various types of platforms, different types of aircraft, characteristics of different types of platforms - LANDSAT, SPOT, IRS, ERS, INSAT and other platforms.

UNIT-III
DATA ACQUISITION Sensors (Visible & Infrared): Photographic products, Resolving power of lenses and films, Opto-mechanical / Electro optical sensors - spatial, spectral and radiometric resolution, Thermal sensors, Geometric Characteristics of thermal imagery, calibration of thermal scanner, signal to noise ratio.

UNIT-IV
DATA ANALYSIS: Data Products and Their Characteristics, Data Pre-processing – Atmospheric, Radiometric, Geometric Corrections - Basic Principles of Visual Interpretation, Equipment for Visual Interpretation, Ground Truth, Ground Truth Equipment.

UNIT-V
MICROWAVE REMOTE SENSING: Active and Passive Systems, Advantages, Platforms and Sensors, Microwave Radiation and Simulation, Principles of Radar – Resolution, Range, Angular Measurements, Microwave Scattering, Imagery – characteristics and Interpretation.

TEXTBOOKS
1. James B. Campbell & Randolph H. Wynne., "Introduction to Remote Sensing", The Guilford Press, 2011.
2. Charles Elach&Jakob van Zyl., "Introduction to the physics and techniques of Remote Sensing", John Wiley & Sons publications, 2006.

REFERENCES

1. Lillesand T.M & Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiely and Sons, 2008.
2. ChritianMatzler.,"Thermal microwave radiation: Applications for remote sensing", The institution of Engineering and Technology, London, 2006.
3. Rees, W. G., "Physical principles of Remote Sensing, Cambridge University Press", 2001
4. Paul Curran P.J., "Principles of Remote Sensing", ELBS Publications, 1985.

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

B.Tech. (VII Sem.)	17EI15 - PC BASED INSTRUMENTATION	L	T	P	Cr.
		2	2	-	3

PREREQUISITE: Transducers, Microprocessors and Microcontrollers

COURSE EDUCATIONAL OBJECTIVE(CEO):In this course student will learn about:
Features of PC based instrumentation system, principles of data acquisition, interfacing to PC using expansion buses, plug in data acquisition and industrial buses.

COURSE OUTCOMES (COs):At the end of this course student will be able to
CO1: Summarize the concept of PC based instrumentation system.
CO2: Identify the features of various data acquisition system.
CO3: Classify PC expansion bus systems.
CO4: Analyze the internal architecture of control boards and their working principles.
CO5: Distinguish between Serial bus and industrial bus for data acquisition.

UNIT – I INTRODUCTION TO PC BASED INSTRUMENTATION SYSTEM
General instrumentation system, feature of personal computers-expansion slots, ports, monitors, storage device, PC Based instrumentation system, Motherboard Component-microprocessor, memory, chipset chips.

UNIT – II PRINCIPLE OF DATA ACQUISITION
Data acquisition systems-analog input, analog output, digital I/O, timing I/O, data acquisition configuration-local, GPIB, serial interface, network data acquisition.

UNIT – III INTERFACING TO PC
Expansion buses – 8 bit ISA bus- pins & signals, design of expansion board.16 bit ISA bus-pins & signals, interfacingADC to PC-AT bus, EISA bus, structure of EISA bus,pin&signal of EISA bus, PCI bus-feature, system.

UNIT – IV PLUG IN DATA ACQUSITION AND CONTROL BOARD
Plug in board-ADC board, DAC board, digital i/o board, timing i/o board,general purpose plug in DAQ board.

UNIT – V DATA ACQUISITION USING SERIAL INTERFACE, GPIB AND NETWORKED DATA ACQUISITION
Serial interface standards-RS-232-pins & signals, drivers/receivers, handshaking,RS-422-charcetrstics,driver/receiver,RS-485-network,USB-features, system, GPIB-overview, system, pins& signals, -HART communication-network connection,field buses-MODBUS-transmission modes,PROFIBUS-DP-slave,master,PROFIBUS PA-physical layer,FOUNDATION field bus-architecture,

TEXT BOOK
N. Mathivanan, "PC based instrumentation concepts and practice" PHI publishers, 2003.

REFERENCES
1. K. Krishna Kanth, "Computer control of process ", Tata McGraw-Hill, 2009.
2. Mike Tooley, "PC-based Instrumentation and Control",2nd edition, Newnes, 1995.

B.Tech. (VII Sem.)	17EI16 - PLC AND SCADA	L	T	P	Cr.
		2	2	-	3

PREREQUISITE: Digital Electronic Circuits, Process Control Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course student will learn about the fundamental principle of PLC, programming of PLC (ladder diagrams) and various hardware and firmware of SCADA system.

COURSE OUTCOMES(COs):At the end of the course, students will be able to
CO1: Summarize the concepts of PLC and supervisory control systems.
CO2: Interpret the basics of PLC ladder language.
CO3: Verify PLC programs in ladder logic using various timers and counters.
CO4: Illustrate the operation of SCADA system.

UNIT – I
INTRODUCTION TO PLC
Definition & History of PLC, PLC advantages & disadvantages, Overall PLC system, PLC Input and Output modules, I/O module (Interfaces), Power supplies,Proper construction of plc ladder diagrams, process scanning consideration

UNIT – II
BASIC PLC PROGRAMMING
PLC i/p instructions, outputs, digital logic gates, Boolean algebra, conversion examples, ladder diagram and sequence listing.

UNIT – III
PLC FUNCTIONS
Registers basic, PLC timer function, PLC Counter functions,PLC arithmetic functions, number comparison functions

UNIT – IV
INTRODUCTION TO SCADA
Introduction and brief history of SCADA, Fundamental principles of modem SCADA systems, SCADA hardware, SCADA software, Landlines for SCADA, Modem use in SCADA system, computer sites and troubleshooting, system implementation.Comparison of terms SCADA, DCS, PLC and smart instrument

UNIT – V
COMPONENTS OF SCADA SYSTEM:
Remote terminal units,Component of SCADA system, SCADA software package, Specialized SCADA protocols,

TEXT BOOKS
1. John W Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles and Application”, Pearson Education, 5th Edition, 2009.
2. David Bailey, Edwin Wright, “Practical SCADA for Industry”, Newns,An Imprint of Elsevier, 2003.

REFERENCES

1. Ronald L. Krutz "Securing SCADA system", Wiley publishing, 2006
2. John R.Hackworth, Frederick D.Hackworth Jr., "Programmble Logic Controllers Programming Methods and applications", 2003

B.Tech. (VII Sem.) **17EI17 - ANALYTICAL INSTRUMENTATION**

L	T	P	Cr.
2	2	-	3

PRE-REQUISITE COURSE: Engineering Chemistry, Applied Physics

COURSE EDUCATIONAL OBJECTIVE(CEO): In this course student will learn about operation of pH meters, Gas analysers,Gas and Liquid chromatography, NMR spectrometers,Mass spectrometers and X-ray spectrometers,pollution monitoring instruments.

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

CO1: Distinguish various types of pH meters & Gas analyzers.
CO2: Illustrate the working principles of Gas and Liquid chromatography.
CO3: Compare single & double beam instruments in UV,VIS and IR regions.
CO4: Interpret the working principle of NMR spectrometer with suitable applications.
CO5: Analyze various types of mass spectrometer, X-ray spectrometer and pollution monitoring instruments.

UNIT – I

ELECTRO-CHEMICAL INSTRUMENTS & PH MEASURING SYSTEMS

Introductionto AI-Objectives-Electro-chemical cell, construction-potentiometers. Conductivity metersconstruction- measurement of conductance. polarographs-types of electrodes instrumentation. -Principles of PH measuring electrodes, measuring-reference-selective ion type measuring circuits, industrial PH-meters.

UNIT – II

SPECTRO PHOTOMETERS

Spectral methods of analysis, Beer's law, UV – visible spectrophotometers, single beam and double beam instruments, sources and detectors, IR spectrophotometers, sources and detectors,FTIR spectrometers, atomic absorption spectrophotometer, flame emission spectrophotometers,sources of flame photometry – applications

UNIT – III

GAS ANALYSER & CHROMATOGRAPHY

Oxygen analyzer, CO monitor, Noxanalyzer, H_2S analyzer, dust and smoke measurementthermal conductivity type - thermal analyzer, industrial analyzers. Gas chromatography, liquid chromatography - principles, types and applications, high-pressure liquid chromatography, detectors.

UNIT – IV

NUCLEAR MAGNETIC RESONANCE AND RADIATION TECHNIQUES

NMR - basic principle,NMRspectrometers,applications,Introduction to Mass spectrophotometers, nuclear radiation detectors, GM counter, proportional counter, solid state detectors, introduction to X-ray spectroscopy

UNIT – V

ENVIRONMENTAL POLLUTION MONITORING INSTRUMENTS

Air pollution monitoring, instrument systems for-carbon monoxide-sulphur dioxide-nitrogen Oxides-hydro carbons ozone automated wet chemical analyzers.

TEXT BOOKS

Willard H.H., Merrit L.L. , Dean J.A., Scattle F.I, "Instrumental methods of Analysis'' 7th Edn., CBS, 1986

REFERENCES

1. Skoog D.A. –"Principles of Instrumental Analysis, Holt Soundes publications" 4th Edn. 1982
2. Man R.S. Khandpur – "Handbook of Analytical Instruments" TMH 1989
3. C.K., Vicker T.J. &Gullick W.H. – "Instrumental Analysis, Harper and Row Publishers" 1974.

B.Tech. (VII 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. (VII Sem.)	17EI19 - SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL	L	T	P	Cr.
		3	-	-	3

Prerequisite: Control systems Engineering, Process control Instrumentation.

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course students will learn about different data driven identification methods, principles of relay based identification and parameter estimation algorithm, modeling and controller design.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:

CO1: Develop various models from the experimental data.
CO2: Select a suitable model and parameter estimation algorithm for the identification of systems.
CO3: Analyze the different Recursive Identification methods.
CO4: Design simple adaptive controllers for linear systems.
CO5: Design various types of self tuning regulators and MRAS.

UNIT – I: NON PARAMETRIC METHODS

Non parametric methods: Transient analysis-frequency analysis-Correlation analysis-Spectral analysis.

UNIT – II: PARAMETRIC METHODS

Linear Regression: The lease square estimate-best liner unbiased estimation under linear constraints-updating the parameter estimates for linear regression models-Prediction error methods: Description of Prediction error methods-Optimal Prediction-relationships between prediction error methods and other identification methods-theoretical analysis.
Instrumental variable methods: description of instrumental variable methods-theoretical analysis covariance matrix of IV estimates-Comparison of Optimal IV prediction error methods

UNIT – III:RECURSIVE IDENTIFICATION METHODS

The recursive least squares method-the recursive instrument variable method- the recursive prediction error method-model validation and model structure determination.
Identification of systems operating in closed loop: Identifiability considerations- direct identification-Indirect identification-joint input-output identification

UNIT – IV: INTRODUCTION TO ADAPTIVE CONTROL

Introduction-Adaptive Schemes – The adaptive Control Problem – Applications – Real time parameter estimation: Least squares and regression methods- Estimating parameters in dynamical systems.

UNIT – V: DETERMINISTIC SELF TUNING REGULATORS

Introduction – Pole Placement design – Indirect self tuning regulators – direct self- tuning regulators.

MODEL REFERENCE ADAPTIVE SYSTEMS (MRAS)

Introduction –-MRAS Block Diagram- MIT rule – Determination of adaptation of adaptation gain – Lyapunav theory– Relations between MRAS and STR.

TEXT BOOK

1. Soderstorm.T and Petrestioca, "System Identification", PHI(UK) Ltd (not available in our library)
2. Karl J.Astrom and Bjorn Wittenmark, "Adaptive Control", Pearson Education, 2nd Edition.

REFERENCES

1. Karel J Keesman, "System Identification an Introduction", Springer, 2011.
2. Ljung L, "System Identification: Theory for the use", PHI.1999.
3. Tao Liu, Furong Gao, "Industrial Process Identification and control design, Step-test and relay-experiment based methods", Springer – Verilog London Ltd,2012.
4. Sastry.S&Bodson M, "Adaptive Control: Stability", Convergence, and Robustness, Prentice Hall, 2011.

B.Tech. (VII Sem.)	17EI20 - INSTRUMENTATION CONTROL IN PAPER INDUSTRIES	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITE: Process Control Instrumentation, Industrial Instrumentation

COURSE EDUCATIONAL OBJECTIVE(CEO): In this course the students will learn about the design Special instruments for Paper Industry and control by computer applications like SCADA, DDC, PLC and DCS designs. It deals with various equipments involved in the paper Industries

COURSE OUTCOMES (COs):

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

CO1: Illustrate the role of paper in various forms in the civilized world.
CO2: Design of Analyzers and control loops used in Paper Industry.
CO3: Identification of various process parameters in the industry.
CO4: Evaluate the Computer application in the Paper Industry.

UNIT-I
ROLE OF PAPER IN VARIOUS FORMS IN THE CIVILIZED WORLD
History of paper making, per-capita consumption of paper and board in India and in other countries. Process description in diagrammatic and functional block details, conventional and non-conventional raw materials for paper manufacture. Various grades of paper; properties of paper.

UNIT-II
DIFFERENT PULPING PROCESSES
Continuous and batch digesters, brown stock washers, bleaching plant, chemical recovery process, paper machine operations, conversion processes. Pulping process involves various chemical processes, impact of effluents and need for treatment and disposal. Paper making is addition and removal of water.

UNIT-III
PROCESS PARAMETERS
Identification of various process parameters in the industry, selection of suitable measurement hardware for flow, pressure, level, temperature, density, solids, consistency, pH, ORP, conductivity. Control room layout for mill operations; graphic displays; alarm management.

UNIT-IV
SPECIAL APPLICATIONS FOR CONTROLS
Digester blow tank controls, digester liquor feed pump control, brown stock washer level control, stock chest level control; dissolving tank density control, white liquor classifier density control, white liquor flow control, condensate conductivity control.

UNIT-V
COMPUTER CONTROL APPLICATIONS
Evolution of computer applications in the industry, Review of data logging, SCADA, PLC and DCS. Computer controls for online basis weight and web moisture in modern mills.

TEXT BOOKS

Liptak, Bela G, "Instrumentation in the Processing Industries", Chilton Publishers,1973Considine.

REFERENCES

1. D. M., "Process/Industrial Instruments and control Handbook", McGraw Hill, 4thedition 1993.
2. Robert H. Perry, "Green D.W. and Maloney J.O., Perry's Chemical Engineers", Handbook, McGraw HillInc, New York, 7th ed, 1998.

B.Tech. (VII Sem.)	17EI21 - INSTRUMENTATION IN AEROSPACE AND NAVIGATION	L	T	P	Cr.
		3	-	-	3

Prerequisite: Transducers, Control Systems Engineering, Mathematics

COURSE EDUCATIONAL OBJECTIVE (CEO): **In this course students will learn about** the basics of aerospace and navigation and necessary instrumentation system.

Course Outcome (COs): At the end of this course, Students will be able to
CO1: Interpret the basics of earth coordinates and advance navigation system.
CO2: Classify instrumentation systems used in aerospace.
CO3: Summarize measurement of various parameters in an aerospace system.
CO4: Summarize how flight simulation occurs.
CO5: Identify the troubles occurring in various systems of aircraft.

UNIT - I
NAVIGATION
Coordinate systems, Global positioning system -space segment, control segment, user segment, GPS error sources -satellite clock error & ephemeris error, troposphere error &ionosphere error, multipath, interference & jamming, tracking loop errors

UNIT - II
MEASUREMENT
Air data instruments: altimeter, air speed rate of climb inertial sensors - accelerometers, gyroscopes, integrated flight instruments Capacitance type fuel level indicating system altitude compensation - magnetic compass instruments landing system - visual omni range

UNIT - III
MEASURING INSTRUMENTS:
Distance measuring equipment, radar, optical instruments, engine instruments and control pressure measurements - thermal meter control, pressure measurement - thermal meter - tachometer accelerometer - smoke and fire detection,

UNIT - IV
PROPELLOR CONTROLS AND GYROS:
propeller controls - cabin pressure and temperature Satellite and space vehicle instrumentations - propulsion controls stabilization - stabilization sensors ,Gyros - Sun sensors ,Horizon sensors ,star tracker - Stabilization controls, air Craft Flight Simulation Instrumentation: Basic description of a flight simulator.

UNIT - V
TROUBLES IN AEROSPACE
Jet engine power plant troubles, Flight controls and auto pilot troubles, Electrical Troubles: Hydraulic systems troubles, landing gear troubles, cabin conditioning troubles, indication of unsafe canopy, Radio troubles, Trouble indicator light

TEXT BOOKS

1. Pallett E.G.H., "Aircraft Instrumentation and Integrated Systems", Longman Scientific and Technical, 1992
2. Nagaraja N.S., "Elements of Electronic Navigation", Tata Mcgraw Hill Publishing Ltd., New Delhi, 1975

REFERENCES

1. EsmatBekir,"Introduction to Modern Navigation Systems", World Scientific Publishing Co. Pvt. Ltd, 2006
2. Maxwell Noton, "Spacecraft Navigation and Guidance", (Advances in Industrial Control), Springer-Verlag London, 1998

B.Tech. (VII Sem.) 17EI22 - AUTOMATION OF INDUSTRIAL PROCESS	L	T	P	Cr.
	3	-	-	3

PREREQUISITE: Control Systems Engineering, Process control Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO):

In this course the student will learn about the need for computers in the control of a system, working of Data acquisition system, Supervisory control and Direct digital control, Sampled data control systems, Pulse transfer function, Data holds ,Sampled data control systems, Digital control algorithms , Advanced control strategies and Distributed digital control system(DCS).

COURSE OUTCOMES (COs): At the end of this course, students will be able to

CO1: Define the role of Computers in a control system, Data acquisition system, Supervisory control and Direct digital control.

CO2: Summarize the features of Sampled data control systems, Pulse transfer function, Data holds and Modified Z-transforms.

CO3: Interpret the working of Distributed digital control system,DCS configuration, DCS communication and DCS integration with PLCs.

CO4: Identify the Digital PID algorithms, Dead beat, Dahlin's and Smith predictorand Analytical Predictor algorithms.

CO5: Categorize advanced control strategies as predictive control,Adaptive control, Inferential control,Intelligent control and optimal control.

UNIT – I

INTRODUCTION TO COMPUTER CONTROL

Introduction to computer control system, need for computers in a control system-functional block diagram of computer control system – Data acquisition system, Supervisory control and Direct digital control

UNIT – II

SAMPLED DATA CONTROL SYSTEMS

Mathematical representation of sampling process-Sampling frequency considerations-selection of optimim sampling period –Z transforms – properties – inverse Z transforms – Pulse transfer function – data holds- transfer function of zero order hold --modified Z transforms ,open loop and closed loop response of sampled data control systems.

UNIT – III

CONTROL ALGORITHMS

PID algorithm – position and velocity forms – Dead beat algorithm – Dahlin's algorithm– Digital equivalent to a conventional control- Algorithms for processes with Dead time-Smith predictor algorithm, Analytical Predictor algorithm

UNIT –IV

ADVANCED STRATEGIES

Predictive Control – Model based and Multivariable System. Adaptive Control – Adjustment, Schemes and Techniques- Inferential Control-Intelligent Control-Statistical Process Control-Optimal Control

UNIT – V

DISTRIBUTED DIGITAL CONTROL

Overview of Distributed Digital Control System (DCS)- DCS Software configuration- DCS Communication – Data Highway -DCS Supervisory computer Tasks-DCS Integration with PLCs and Computers.

TEXT BOOKS:

1. S.K.Singh , "Computer Aided Process Control" , PHI, 2004.
2. Pradeep B, Despande and Raymond H. Ash, "Elements of Computer Process Control with Advanced Control Applications", Instrument Society of America, 1981.

REFERENCES

1. M.Chidambaram, "Computer Control of Processes", Narosa Publications, 2003.
2. Krishna Kant , "Computer-based Industrial Control", PHI, 1997
3. S. Bennett," Real Time Control: An Introduction", Pearson Education India, 2nd edition, 2003
4. C.D. Johnson, "Process Control Instrumentation Technology", Prentice Hall, 1988.

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.)	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

B.Tech. (VII Sem.)	17EI23 - INSTRUMENTATION IN PETRO CHEMICAL INDUSTRIES	L	T	P	Cr.
		3	-	-	3

PREREQUISITE: Process control Instrumentation, Industrial Instrumentation

COURSE EDUCATIONAL OBJECTIVE:In this course student will learn about the extraction and production of Oil and Gas to meet energy needs, refining of crude oil and acquire knowledge on various equipments involved in the Petrochemical Industries like Distillation Column, Reactor, Heat exchangers, Evaporators and pumps also.

COURSE OUTCOMES:After the completion of the course, students should be able to:

CO1: Interpret petroleum exploration, production and refining.
CO2: Illustrate crude oil distillation process and control of distillation column in petrochemical industry.
CO3: Analyze working methodologies of controls for chemical reactors
CO4: Analyze the Evaporators in petroleum refinery.
CO5: Discuss about Control of pumps and Water Treatment.

UNIT – I
PETROLEUM EXPLORATION
Introduction: Petroleum Exploration, production and Refining, Refining Capacity in India, Consumption of Petroleum products in India, Constituents of Crude Oil, P & I diagram of petroleum refinery.

UNIT–II
CRUDE OIL DISTILLATION
Atmospheric Distillation of Crude oil - Vacuum Distillation process - Thermal Conversion process - Control of Distillation Column - Temperature Control - Pressure control - Feed control - Reflux Control - Reboiler Control.

UNIT-III
CHEMICAL REACTORS AND DRYERS
Introduction of Chemical reactors, Temperature and Pressure Control of Chemical reactors, Control of Dryers, Batch Dryers, Continuous Dryers, control of Dryers- Cascade Control, Feed forward Control.

UNIT-IV
HEAT EXCHANGERS
Variables and Degrees of freedom, Liquid to Liquid Heat Exchangers, Steam Heaters, Condensers, Reboiler and Vaporizers.

UNIT-V
CONTROLS FOR EVAPORATORS AND PUMPS
Types of Evaporators. - Evaporators in Petroleum refinery- Cascade Control - Feed forward Control. Centrifugal pump: On-Off level control - Pressure control - Flow control - Throttling control. Rotary pumps: On-Off pressure control.-Reciprocating Pumps: On-Off control and Throttling control.

TEXT BOOK

1. Dr. Ram Prasad, "Petroleum Refining Technology", Khanna Publisher, 1st Edition, 2000
2. B.G. Liptak, "Instrumentation in Process Industries", Chilton Book Company, 1973

REFERENCES

1. M. Considine and S.D. Ross, "Handbook of Applied Instrumentation", McGraw Hill, 1962.
2. B.G. Liptak, "Instrument Engineers Handbook", Chilton Book Company, Volume II, 1989

B.Tech. (VII Sem.)	17EI65 - ANALYTICAL INSTRUMENTATION AND PC BASED INSTRUMENTATION LAB	L	T	P	Cr.
		-	-	2	1

PREREQUISITE: Engineering chemistry,Applied Physics, Transducers

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course student will learn about– Interfacing of two computers using serial port communicator (RS-232), measurement of process variables, Analog to Digital Conversion, Digital to Analog Conversion, methods for measuring Calorific value, chromatograms & atomic emission.

COURSE OUTCOMES (COs):At the end of this lab course, student will be able to
CO1: Verify serial port communication by interfacing two computers.
CO2: Measure process variable using data acquisition.
CO3: Convert ADC and DAC by using DAQ
CO4: Analyze the gases by using liquid and gas chromatography.

List of Experiments:
P.C. Based Instrumentation:
1. Serial communication through RS232C between PCs
2. Data Acquisition of physical Variables
3. Interfacing of ADC to PC.
4. Interfacing of DAC to PC & generate various types of signals.
5. GPIB Interface – master to slave data transfer
6. Interfacing PLC trainer with PC

Analytical Instrumentation:
1. Flame photometer
2. UVVIS spectrometer
3. Liquid Chromatography
4. Gas Chromatography
5. Measurement of Calorific Value
6. $_{P}$H Measurement

NOTE: Minimum 10 experiments can be conducted from the above list.

B.Tech. (VII Sem.)	17EI66 - PROGRAMMABLE LOGIC CONTROLLERS LAB	L	T	P	Cr.
		-	-	2	1

PREREQUISITE: Digital Electronics Circuits

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course student will learn about:
The Operation of PLC system, Programming of PLC using ladder diagrams, controlling of process variables and automation of various systems using PLC.

COURSE OUTCOMES (COs):At the end of this course student will be able to
CO1: Classify the Hardware /Software structure of PLC system.
CO2: Test Programs using ladder diagrams.
CO3: Measurevarious process variables using PLC.
CO4: Design various automate systems using PLC.

LIST OF EXPERIMENTS:

1. Basic PLC Simulator
2. Boolean gate realization using PLC ladder.
3. Implement of ON-DELAY and OFF-DELAY timer by using PLC ladder.
4. Water level control using PLC ladder.
5. Traffic light control system using PLC ladder.
6. Automatic Bottle Filling system using PLC ladder.
7. speed of DC Motor controlusing PLC ladder
8. Pressure controller system using PLC ladder.
9. Implement 4:1 MUX by using PLC ladder.
10. Implement of counter by using a PLC ladder.

B.Tech. (VII Sem.)	17EI92 - TELEMETRY AND TELEMEDICINE (*Add on course – III)	L	T	P	Cr.
		3	-	-	3

PREREQUISITE: Communication systems, Bio Medical Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course, students will learn about the Principles of telemetry, TDM & FDM.Symbols & coding methods. Functioning of Satellite &Optical communication systems. Importance of telemedicine and their applications.

COURSE OUTCOMES: After completion of this course, the students will be able to:

CO1: Discuss the fundamentals of functional blocks and methods of telemetry System.

CO2: Illustrate the coding techniques.

CO3: Interpretthe frequency and time division multiplexed systems.

CO4: Apply the fundamentals to realize transmitter and receiver circuits in satellite and optical communication systems.

CO5: Discuss the functional blocks of telemedicine system and its usage in mobile communications.

UNIT – I: TELEMETRY PINCIPLES

Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non Electrical, Electrical, Pneumatic, Frequency, Power Line Carrier Communication.

UNIT – II:SYMBOLS AND CODES

Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes. Inter symbol Interference.

UNIT – III:FREQUENCY&TIME DIVISION MULTIPLXED SYSTEMS

FDM, IRIG Standard, FM and PM Circuits, Receiving end, PLL Time Division Multiplexed Systems: TDM-PAM, PAM /PM and TDM – PCM Systems.PCM reception. Differential PCM. Introduction to QAM, Protocols.

UNIT – IV:FIBRE OPTIC TELEMETRY

Basics of Satellite Telemetry**:** General considerations, TT&C Service, Digital Transmission systems, TT&C Subsystems, Telemetry and Communications. Fibre Optical Telemetry**:** Optical fibres Cable – Sources and detectors – Tele Transmitter and Receiving Circuits, Coherent Optical Fibre Communication System.

UNIT – V: TELEMEDICINE

Functional block diagram of telemedicine system – Telemedicine concepts - essential parameters of telemedicine – applications – Telemedicine technology – video conferencing – digital communication system – Telemedicine using mobile communications – use of Internet resource for telemedicine

TEXT BOOK:

1. D. Patranabis, "Telemetry Principles", TMH, 2007.
2. R.E.Young "Telemetry Engineering" Hardcover – January, 1968

REFERENCES

1. Dr.R.SKhandpur, " Handbook of Bio Medical Instrumentation" second edition, TMH,1992.
2. RangarajM.Rangayyan, "Biomedical Signal Analysis" John Wiley & Sons, 2015
3. A.C.Norris,"Essentials of Telemedicine and Telecare" Wiley; 1 edition (December 21, 2001)

B.Tech. (VIII Sem.)	17EI24 - ADVANCED SENSORS	L	T	P	Cr.
		3	-	-	3

Prerequisite: Transducers

COURSE EDUCATIONAL OBJECTIVE (CEO):In this course students will learn about basic principles, functions of different sensors including latest sensor technologies and their applications.

COURSE OUTCOMES (COs): After completion of the course, students will be able to:
CO1: Apply the concepts of thermal sensors for temperature measurement.
CO2: Analyze the working principles of Magnetic sensors.
CO3:Summarize smart sensors based on physical parameters.
CO4:Illustrate the recent trends in sensor technology.
CO5: Categorize sensors for environmental monitoring and automobile applications.

UNIT – I:THERMAL SENSORS
Thermal expansion type, dielectric constant and refractive index thermo sensors, magnetic thermometer, thermo sensors using semiconductor devices, PTAT sensors, Quartz crystal thermoelectric sensors, NQR thermometry, noise thermometry, heat flux sensors

UNIT – II:MAGNETIC SENSORS
Introduction, sensors & the Principles behind, Eddy Current sensor, Hall Effect & Sensor, Electro Magnetic Flow meter, switching magnetic sensors.

UNIT – III:SMART SENSORS
Smart sensors: Primary sensors, Excitation, Converters, non-linearity, noise, response time, Drift, cross sensitivity, interference and their compensation, information coding and data Communication

UNIT – IV:RECENT TRENDS IN SENSOR TECHNOLOGIES
Introduction, Film Sensors: Thin films& Thick film sensors, Semiconductor IC technology MEMS:-Micro machining, some applications examples.

UNIT – V:SENSOR –THEIR APPLICATIONS
On board Automobile Sensors (Automotive Sensors): Flow-rate sensor, Pressure Sensor, Oxygen Sensor.
Sensors for environmental monitoring – pollution hazards, Sensing environmental pollution, Ecological studies of air.

TEXT BOOK
1. D.Patranabis, "Sensors and Transducers" Wheeler Publishing, New Delhi, 1997.
2. Pavel Ripka, AloisTipek, "Modern sensors Handbook" ISTE Ltd,2007.

REFERENCE BOOKS
1. S. Middle Hock and S.A. Andel, "Silicon Sensors" , Academic Press, London, 1989.
2. Ashok Vaseashta ,SurikKhudaverdyan,"Advanced Sensors for Safety and Security", Springer Netherlands,2013
3. Randy Frak, "Understanding Smart Sensors" Artech House Remote Sensing Library, Third Edition,2013
4. Jacob Fraden,"Hand Book of Modern Sensors" Springer; 3rd edition ,December 4, 2003

B.Tech. (VIII Sem.)	17EI25 - ADVANCED PROCESS CONTROL	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITE COURSE: Control Systems Engineering, Process control Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO): In this course the student will learn aboutcontrol of Time-varying, Non-linear systems, optimal control, filtering and fractional order system and controller.

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

CO1: Summarize models for time varying and Non-linear systems, model validation and different types of adaptive control schemes.
CO2: Illustrate the optimal controller solving techniques.
CO3: Analyze fractional order linear systems, filter approximation model detection techniques and controller designs.
CO4: Design optimal H2 controller and H-infinity controller.
CO5: Select suitable sensor and actuator for fault diagnosis.

UNIT – I : CONTROL OF TIME-VARYING AND NONLINEAR SYSTEMS

Models for Time-varying and Nonlinear systems – Input signal design for Identification –Real time parameter estimation – Model Validation - Types of Adaptive Control - Gain scheduling - Adaptive Control - Deterministic Self-tuning Controller and Model Reference Adaptive Controller – Control of Hammerstein and Wiener Systems

UNIT – II : OPTIMAL CONTROL & FILTERING

Introduction – Performance Measure for optimal control problem – Dynamic Programming – Computational Procedure for solving Control Problem – LQR – Introduction to Optimal Filtering– Discrete Kalman Filter – LQG

UNIT – III : FRACTIONAL ORDER SYSTEM AND CONTROLLER

Fractional-order Calculus and Its Computations – Frequency and Time Domain Analysis of Fractional-Order Linear Systems. Filter Approximations to Fractional-Order Differentiations – Model reduction Techniques for Fractional Order Systems –Controller Design Studies for Fractional Order

UNIT – IV : H-INFINITY CONTROLLER

Introduction – Norms for Signals – Robust Stability – Robust Performance – Small GainTheorem – Optimal H2 Controller Design - H-Infinity Controller Design — Effects of Weighting Functions in H-Infinity Control.

UNIT – V :FAULT DIAGNOSIS AND FAULT-TOLERANT CONTROL

Process Monitoring - Introduction – Statistical Process Control – Fault Detection with Principal Component Analysis – Fault Detection with State Observers – Fault Detection with signal models - Fault Detection of Control Loops- Sensor and Actuator Fault-Tolerant Control Design

TEXT BOOKS

1. K. J. Astrom and B. J. Wittenmark, "Adaptive Control", Pearson Education, Second Edition,2008.

2 . Donald E. Kirk, "Optimal Control Theory – An Introduction", Dover Publications, Inc. Mineola, New York, 2004

REFERENCES

1. D. Xue, Y. Q.Chen, D.P.Atherton, "inear Feedback Control Analysis and Design with MATLAB, Advances In Design and Control", Society for Industrial and Applied Mathematics, 2007.
2. R. Isermann, "Fault-Diagnosis Systems: An Introduction from Fault Detection to Fault Tolerance" Springer, 2005

B.Tech. (VIII 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.

B.Tech. (VIII Sem.) 17EI26 - ADVANCED CONTROL SYSTEM DESIGN

L	T	P	Cr.
3	-	-	3

PREREQUISITE: Control Systems Engineering

COURSE EDUCATIONAL OBJECTIVE (CEO): In this course the students will learn about state space, phase plane and stability analysis including controllability and observability.

COURSE OUTCOME (COs): After completion of the course, the students will be able to:

CO1: Derive the Canonical Forms such as controllable, Observable and Jordan.
CO2: Verify controllability and observability for continuous time systems.
CO3: Illustrate the functions of non linear control systems.
CO4: Construct the Trajectories for singular points and phase-plane analysis of nonlinear control systems.
CO5: Analyse the stability by using Lyapunov's functions.
CO6: Design controllers using the concept of state feedback and pole placement technique.

UNIT – I :STATE SPACE ANALYSIS:

State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms –Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form.

UNIT – II :CONTROLLABILITY AND OBSERVABILITY:

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.

UNIT – III :DESCRIBING FUNCTION ANALYSIS:

Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.

UNIT-IV :PHASE-PLANE ANALYSIS:

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points,phase-plane analysis of nonlinear control systems.

STABILITY ANALYSIS

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov's instability theorems.DirectmethodofLypanov for the Linear and Nonlinear continuous time autonomous systems.

UNIT-V :MODERN CONTROL

Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.

TEXT BOOKS

1. M. Gopal, "Modern Control System Theory",New Age International Publishers, 2nd edition, 1996

REFERENCES

1. K. Ogata, " Modern Control Engineering",Prentice Hall of India, 3rd edition, 1998.
2. I.J. Nagarath and M.Gopal, "Control Systems Engineering" New Age International (P) Ltd.
3. M. Gopal , "Digital Control and State Variable Methods", Tata McGraw-Hill Companies, 1997.
4. Stainslaw H. Zak, "Systems and Control", Oxford Press, 2003.

B.Tech. (VIII Sem.) **17EI27 - POWER PLANT INSTRUMENTATION**

L	T	P	Cr.
3	-	-	3

PREREQUISITE: Transducers, Industrial Instrumentation

COURSE EDUCATIONAL OBJECTIVE (CEO): In this course students will learn aboutthe importance of various power plants, renewable energy sources and auxiliary parts of Steam boilers & Steam Turbines.

COURSE OUTCOMES (COs):After completion of the course, students will be able to

CO1: Analyze various power plants used to generate electricity.
CO2: Classify and discuss the elements and operation of boilers which can be used effectively inpower plants.
CO3: Classify and discuss the elements and operation of turbines which can be used effectively in power plants.
CO4: Identify and apply the principles of renewable energy sources to generate electricity.

UNIT-I :INTRODUCTION TO POWER PLANT INSTRUMENTATION:
Various Conventional and Non-conventional Power Plants- Importance of Instrumentation in power generation – Various Mechanical and Electrical Transducers used in power plants (briefly)

UNIT-II :THERMAL POWER PLANT:
Basic Building Blocks of Thermal power plants - Emission control: Particulate control – Nitrogen Oxide emission control- sulfur dioxide emission control – NOx and SO_2 Removal.

UNIT-III :STEAM GENERATOR :
Steam Generator systems-excess air – steam temperature control – minimum load capability – flue gas emissions – feed water quality –steam purity –steam generator arrangement – startup system Types of Boilers -Furnace-drum boiler – super heater-Reheater-Economizer-air heater – soot blowers-coal feeder –pulverizes burner ignites-warm-up burner-Ash Hoppers Damper

UNIT-IV :STEAM TURBINES & WATER CIRCULATION SYSTEM:
Operating principles – steam expansion – electrical energy – turbine types-steam turbine component – components of steam generator – steam flow control. Circulation of water system – cooling pond – Recirculation cooling system – components of circulation water system.

UNIT-V :PLANT CONTROL & EMERGING TECHNOLOGIES:
Plant Control System: Feed forward Control – Cascade Control – Feed water flow control – Boiler Feedpump Recirculation control, Renewable Techniques: solar – wind – bio mass – ocean – geothermal , Fusion Techniques: Magnetic confinement concept – Inertial confinement Techniques.

TEXT BOOK
Black & Veatch , "Power Plant Engineering", Chapman & Hall Inc- NewYork, CBS Publishers & Distributors, New Delhi (for Indian Reprint edition)- 2005.

REFERENCES
1. Oxford ,"Instrumentation, Controls and Testing", Pergamon Press, Modern Power Station Practice, Vol. 6, 1971.
2. Sam G Dukelow, "The Control of Boilers", ISA Publication, 2nd Edition, 1991.
3. Elokna S.M. and Kohal A., "Stand Boiler Operations", Questions and Answers TMH, New Delhi, 1994.

B.Tech. (VIII 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. (VIII Sem.)	17EI28 - AUTOMOTIVE SENSORS	L	T	P	Cr.
		3	-	-	3

PRE-REQUISITE COURSE: Transducers, Electrical Technology, Industrial Instrumentation.

COURSE EDUCATIONAL OBJECTIVE (CEO): In this course student will learn aboutthe fundamentalsof automotive vehicle construction, various types of sensors for Transportation, automotive vehicle convenience and security systems and different types of Actuators used in automotive vehicles (MEMS based Automotive sensors).

COURSE OUTCOMES (COs): At the end of the course student will be able to

CO1: State the principles and fundamentals of automotive sensors.

CO2: Interpretthe operation of various sensors, which can be used in vehicle body, power train, and chassis.

CO3: Compare various sensors used for vehicle convenience and security systems.

CO4: Differentiate the fundamentals of motor based actuators.

CO5: Summarize MEMS based automotive sensors.

UNIT – I : CHASSIS (STEERING, SUSPENSION, BRAKING AND STABILITY)

Vehicle construction – Chassis and body – Specifications – construction
Steering and Suspension: Principle of steering – steering geometry and wheel alignment – steering linkages, front axle – power steering. Active Suspension System (ASS)
Brakes: Need – types – mechanical, hydraulic and pneumatic, power brake. Suspension system - independent coil and leaf spring and air suspensions, torsion bar, shock absorbers.

UNIT – II: SENSORS FOR TRANSPORTATION

Vehicle Body:- Sensors Flap air flow sensors, Ranging radar (ACC) Power Train:- Fuel level sensors, Lambda Oxygen sensor, Hotwire air mass meter Chassis:- Steering wheel angle sensor, Vibration and acceleration sensors.

UNIT–III :SENSORS FOR AUTOMOTIVE VEHICLE CONVENIENCE AND SECURITY SYSTEMS

Tyre pressure monitoring systems, Two wheeler and Four wheeler security systems, parking guide systems, anti lock braking system. Vehicle diagnostics and health monitoring, Traction Control, Vehicle Dynamics Control, accelerators and tilt sensors for sensing skidding and anti collision - anti collision techniques using ultrasonic Doppler sensors.

UNIT – IV :ACTUATORS

Automotive Actuator Technologies-Operation and application of DC brushless motors and switched reluctance motors, Magneto-rheological Actuators-Suspension semi active actuators, Mangeto-strictive anti vibration actuators, Piezo Actuators, Micro positioning.

UNIT – V: MEMS BASED AUTOMOTIVE SENSORS

Micro systems in Automobiles- an Overview, different types of MEMS based Sensors for Drive train Control, Safety Systems and Comfort Systems. NOX sensors.

TEXT BOOKS

1. R. B. Gupta, "Automobile Engineering", Satya Prakasam Publishers, New Delhi 1993.
2. ROBERT BOSCH, "Automotive Electrics, Automotive Electronics: Systems & Components", 4th Ed.,. 2005

REFERENCES

1. Joseph Heitner, "Automotive Mechanics", Affiliated East West Pvt. LTD.
2. Robert Bosch , "Automotive Sensors", BOSCH. 2002
3. Ronald K. Jurgen, "Sensors and Transducers, 2nd Edition, SAE, 2003.
4. Tai-Ran Hsu, "MEMS & Microsystem, Design and Manufacture", McGraw Hill, 2002.

B.Tech. (VIII 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