AFFILIATED INSTITUTIONS

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

R - 2013

<u>**PROGRAM EDUCATIONAL OBJECTIVES**</u> **:**

1. To prepare the students   have successful career in industry and motivate for higher education.
2. To provide strong foundation in basic science and mathematics necessary to formulate, solve and analyze Electronics and Instrumentation problems
3. To provide strong foundation in circuit theory, control theory and signal processing concepts.
4. To provide good knowledge of Instrumentation systems and their applications.
5. To provide knowledge on basic electronics and their applications in Instrumentation engineering
6. To provide an opportunity to work in inter disciplinary groups
7. To promote student awareness for life long learning and inculcate professional ethics
8. To provide necessary foundation on computational platforms and software applications related to the respective field of engineering.

<u>**PROGRAM OUTCOMES**</u> **:**

a) Ability to understand and apply differential equations, integrals, matrix theory, probability theory and Laplace, Fourier and Z transformations for engineering problems
b) Ability to understand and apply basic science, circuit theory, control theory and signal processing concepts to engineering problems.
c) Ability to model and analyze transducers.
d) Ability to understand and analyze Instrumentation systems and their applications to various industries.
e) Ability to understand and analyse process control engineering problems.
f) Ability to understand and analyse, linear and digital electronic circuits.
g) Ability to review, prepare and present technological developments
h) Ability to form a group and develop or solve engineering hardware and problems
i) To understand and apply computing platform and software for engineering problems.
j) To understand ethical issues environmental impact and acquire management skills.

Program Educational Objective	Program Outcome									
	a	b	c	d	e	f	g	h	i	j
1		x		x		x	x		x	x
2	x									
3		x								
4				x						
5						x				
6								x		
7							x	x		
8						x			x	

ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R – 2013

B. E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

I TO VIII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS6151	Technical English - I	3	1	0	4
2.	MA6151	Mathematics - I	3	1	0	4
3.	PH6151	Engineering Physics - I	3	0	0	3
4.	CY6151	Engineering Chemistry - I	3	0	0	3
5.	GE6151	Computer Programming	3	0	0	3
6.	GE6152	Engineering Graphics	2	0	3	4
PRACTICAL						
7.	GE6161	Computer Practices Laboratory	0	0	3	2
8.	GE6162	Engineering Practices Laboratory	0	0	3	2
9.	GE6163	Physics and Chemistry Laboratory - I	0	0	2	1
			17	**2**	**11**	**26**

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS6251	Technical English - II	3	1	0	4
2.	MA6251	Mathematics - II	3	1	0	4
3.	PH6251	Engineering Physics - II	3	0	0	3
4.	CY6251	Engineering Chemistry - II	3	0	0	3
5.	GE6251	Basic Civil and Mechanical Engineering	4	0	0	4
6.	EE6201	Circuit Theory	3	1	0	4
PRACTICAL						
7.	GE6262	Physics and Chemistry Laboratory - II	0	0	2	1
8.	GE6263	Computer Programming Laboratory	0	1	2	2
9.	EE6211	Electric Circuits Laboratory	0	0	3	2
		TOTAL	**19**	**4**	**7**	**27**

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA6351	Transforms and Partial Differential Equations	3	1	0	4
2.	GE6351	Environmental Science and Engineering	3	0	0	3
3.	EE6301	Digital Logic Circuits	3	1	0	4
4.	EC6202	Electronic Devices and Circuits	3	1	0	4
5.	EE6303	Linear Integrated Circuits and Applications	3	0	0	3
6.	EI6301	Electrical Measurements	3	1	0	4
PRACTICAL						
7.	EC6361	Electronics Laboratory	0	0	3	2
8.	EE6311	Linear and Digital Integrated Circuits Laboratory	0	0	3	2
		TOTAL	**18**	**4**	**6**	**26**

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA6459	Numerical Methods	3	1	0	4
2.	CS6456	Object Oriented Programming	3	0	0	3
3.	EI6401	Transducer Engineering	3	0	0	3
4.	EE6403	Discrete Time Systems and Signal Processing	3	0	0	3
5.	EI6402	Electrical Machines	3	1	0	4
6.	EI6403	Applied Thermodynamics and Fluid Dynamics	3	1	0	4
PRACTICAL						
7.	CS6461	Object Oriented Programming Laboratory	0	0	3	2
8.	EI6411	Electrical Machines Laboratory	0	0	3	2
		TOTAL	**18**	**3**	**6**	**25**

SEMESTER V

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EE6502	Microprocessors and Microcontrollers	3	0	0	3
2.	IC6501	Control Systems	3	1	0	4
3.	EE6503	Power Electronics	3	0	0	3
4.	EI6501	Analytical Instruments	3	0	0	3
5.	EI6502	Industrial Instrumentation – I	3	0	0	3
6.		Elective – I	3	0	0	3
PRACTICAL						
7.	EE6612	Microprocessors and Microcontrollers Laboratory	0	0	3	2
8.	EI6511	Transducers and Measurements Laboratory	0	0	3	2
9.	GE6674	Communication and Soft Skills- Laboratory Based	0	0	4	2
		TOTAL	**18**	**1**	**10**	**25**

SEMESTER VI

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EI6601	Modern Electronic Instrumentation	3	0	0	3
2.	EI6602	Process Control	3	1	0	4
3.	EI6603	Industrial Instrumentation – II	3	0	0	3
4.	EC6651	Communication Engineering	3	0	0	3
5.	EE6602	Embedded Systems	3	0	0	3
6.		Elective –II	3	0	0	3
PRACTICAL						
7.	EI6611	Industrial Instrumentation Laboratory	0	0	3	2
8.	EI6612	Process Control Laboratory	0	0	3	2
		TOTAL	**18**	**1**	**6**	**23**

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EI6701	Industrial Data Networks	3	0	0	3
2.	EI6702	Logic and Distributed Control System	3	0	0	3
3.	EC6601	VLSI Design	3	0	0	3
4.	EI6703	Fibre Optics and Laser Instruments	3	0	0	3
5.	EI6704	Biomedical Instrumentation	3	0	0	3
6.		Elective – III	3	0	0	3
PRACTICAL						
7.	EC6612	VLSI Design Laboratory	0	0	3	2
8.	EI6711	Instrumentation System Design Laboratory	0	0	3	2
9.	EI6712	Comprehension	0	0	2	1
		TOTAL	**18**	**0**	**8**	**23**

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MG6851	Principles of Management	3	0	0	3
2.	EI6801	Computer Control of Processes	3	0	0	3
3.		Elective – IV	3	0	0	3
PRACTICAL						
4.	EI6811	Project Work	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

TOTAL CREDITS: 190

ELECTIVES - I

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CS6659	Artificial Intelligence	3	0	0	3
2.	CS6303	Computer Architecture	3	0	0	3
3.	CS6401	Operating Systems	3	0	0	3
4.	EI6001	Data Structures and Algorithms	3	0	0	3

ELECTIVE – II

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
5.	EI6002	Power Plant Instrumentation	3	0	0	3
6.	EI6003	Instrumentation in Petrochemical Industries	3	0	0	3
7.	IT6005	Digital Image Processing	3	0	0	3
8.	IC6601	Advanced Control System	3	0	0	3
9.	EE6003	Optimisation Techniques	3	0	0	3

ELECTIVE - III

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
10.	EE6007	Micro Electro Mechanical Systems	3	0	0	3
11.	EE6008	Microcontroller Based System Design	3	0	0	3
12.	EE6006	Applied Soft Computing	3	0	0	3
13.	IC6701	Digital Control System	3	0	0	3
14.	GE6081	Fundamentals of Nanoscience	3	0	0	3
15.	IC6002	System Identification and Adaptive Control	3	0	0	3
16.	GE6083	Disaster Management	3	0	0	3

ELECTIVE - IV

S.NO.	COURSE CODE	COURSE TITLE	L	T	P	C
17.	GE6757	Total Quality Management	3	0	0	3
18.	GE6075	Professional Ethics in Engineering	3	0	0	3
19.	IC6003	Principles of Robotics	3	0	0	3
20.	EC6002	Advanced Digital Signal Processing	3	0	0	3
21.	GE6084	Human Rights	3	0	0	3

HS6151   **TECHNICAL ENGLISH – I**   **L T P C**
                                                                                          3 1 0 4

OBJECTIVES:
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I   **9+3**
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II   **9+3**
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III   **9+3**
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV   **9+3**
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V   **9+3**

Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Learners should be able to

- speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006.
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi. 2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi. 2001.
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.
- ✓ Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- ✓ Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- ✓ Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151   **MATHEMATICS – I**   **L T P C**
                                                                                  3 1 0 4

OBJECTIVES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I   MATRICES   9+3
Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II   SEQUENCES AND SERIES   9+3
Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms –
Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test – Alternating series –
Leibnitz's test – Series of positive and negative terms – Absolute and conditional convergence.

UNIT III   APPLICATIONS OF DIFFERENTIAL CALCULUS   9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes
– Envelopes - Evolute as envelope of normals.

UNIT IV   DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES   9+3
Limits and Continuity – Partial derivatives – Total derivative – Differentiation of implicit functions –
Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of
functions of two variables – Lagrange's method of undetermined multipliers.

UNIT V   MULTIPLE INTEGRALS   9+3
Double integrals in cartesian and polar coordinates – Change of order of integration – Area enclosed
by plane curves – Change of variables in double integrals – Area of a curved surface - Triple integrals
– Volume of Solids.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- This course equips students to have basic knowledge and understanding in one fields of
  materials, integral and differential calculus.

TEXT BOOKS:
1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi
   Publications Pvt Ltd., 2011.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi,
   2011.

REFERENCES:
1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd.,
   2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education,
   2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing
   Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics", Volume I,
   Second Edition, PEARSON Publishing, 2011.

PH6151   **ENGINEERING PHYSICS – I**   **L T P C**
                                                                              3 0 0 3

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I   CRYSTAL PHYSICS   9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II   PROPERTIES OF MATTER AND THERMAL PHYSICS   9
Elasticity- Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders
Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III   QUANTUM PHYSICS   9
Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment -Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV   ACOUSTICS AND ULTRASONICS   9
Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies.
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V   PHOTONICS AND FIBRE OPTICS   9
Spontaneous   and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2, Semiconductor lasers (homojunction & heterojunction)- Industrial and Medical Applications.
Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.
                                                                              TOTAL: 45 PERIODS
OUTCOMES:
- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1.   Arumugam M. Engineering Physics. Anuradha publishers, 2010

2.   Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009
3.   Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:
1.   Searls and Zemansky. University Physics, 2009
2.   Mani P. Engineering Physics I. Dhanam Publications, 2011
3.   Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4.   Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011
5.   Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
6.   Senthilkumar G. Engineering Physics I. VRB Publishers, 2011.

CY6151   **ENGINEERING CHEMISTRY - I**   **L T P C**
                                                                                  3 0 0 3

OBJECTIVES:
- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I   POLYMER CHEMISTRY   9
Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II   CHEMICAL THERMODYNAMICS   9
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore(problems).

UNIT III   PHOTOCHEMISTRY AND SPECTROSCOPY   9
Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

UNIT IV   PHASE RULE AND ALLOYS   9
Phase rule: Introduction, definition of terms with examples, One Component System- water system - Reduced phase rule - Two Component Systems- classification – lead-silver system, zinc-magnesium system. Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements- Ferrous alloys- Nichrome and Stainless steel – heat treatment of steel; Non-ferrous alloys – brass and bronze.

UNIT V   NANOCHEMISTRY   9
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS

OUTCOMES:
- The knowledge gained on polymer chemistry, thermodynamics. spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:
1. Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCES:
1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.
3. Gowariker V.R. , Viswanathan N.V. and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006.
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

GE6151   COMPUTER PROGRAMMING   L T P C
3 0 0 3

OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I   INTRODUCTION   8
Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II   C PROGRAMMING BASICS   10
Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III   ARRAYS AND STRINGS   9
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV   FUNCTIONS AND POINTERS   9
Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V   STRUCTURES AND UNIONS   9
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

                                                                                TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• 		Design C Programs for problems.
• 		Write and execute C programs for simple applications.

TEXTBOOKS:

1. 		Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. 		Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
3. 		Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES:
1. 		Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. 		Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3. 		Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

GE6152   **ENGINEERING GRAPHICS**   **L T   P C**
                                                                          2 0   3 4

OBJECTIVES:

* To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
* To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)   **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I   PLANE CURVES AND FREE HAND SKETCHING   **5+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II   PROJECTION OF POINTS, LINES AND PLANE SURFACES   **5+9**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III   PROJECTION OF SOLIDS   **5+9**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

**UNIT IV   PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF
                 SURFACES**   **5+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS   **6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and   cylinders by visual ray method .

COMPUTER AIDED DRAFTING (Demonstration Only)   **3**

Introduction to drafting packages and demonstration of their use.

                                                              TOTAL : 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- perform free hand sketching of basic geometrical constructions and multiple views of objects.
- do orthographic projection of lines and plane surfaces.
- draw projections and solids and development of surfaces.
- prepare isometric and perspective sections of simple solids.
- demonstrate computer aided drafting.

TEXT BOOK:
1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

REFERENCES:
1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:
1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE6161   **COMPUTER PRACTICES LABORATORY**   **L T P C**
                                                                          0 0 3 2

OBJECTIVES:
The student should be made to:
- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:
1.   Search, generate, manipulate data using MS office/ Open Office
2.   Presentation and Visualization – graphs, charts, 2D, 3D
3.   Problem formulation, Problem Solving and Flowcharts
4.   C Programming using Simple statements and expressions
5.   Scientific problem solving using decision making and looping.
6.   Simple programming for one dimensional and two dimensional arrays.
7.   Solving problems using String functions
8.   Programs with user defined functions – Includes Parameter Passing
9.   Program using Recursive Function and conversion from given program to flow chart.
10.   Program using structures and unions.

                                                                   TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler   30 Nos.

                    (or)
 Server with C compiler supporting 30 terminals or more.

GE6162   **ENGINEERING PRACTICES LABORATORY**   **L T P C**
                                                                     0 0 3 2

OBJECTIVES:
- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I   CIVIL ENGINEERING PRACTICE   9

Buildings:

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
      (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
      (b) Study of pipe connections requirements for pumps and turbines.
      (c) Preparation of plumbing line sketches for water supply and sewage works.
      (d) Hands-on-exercise:

        Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

      (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
      (a) Study of the joints in roofs, doors, windows and furniture.
      (b) Hands-on-exercise:

        Wood work, joints by sawing, planing and cutting.

II   MECHANICAL ENGINEERING PRACTICE   13

Welding:
      (a) Preparation of arc welding of butt joints, lap joints and tee joints.
      (b) Gas welding practice
Basic Machining:
      (a) Simple Turning and Taper turning
      (b) Drilling Practice

Sheet Metal Work:
      (a) Forming & Bending:
      (b) Model making – Trays, funnels, etc.
      (c) Different type of joints.

Machine assembly practice:
     (a) Study of centrifugal pump
     (b) Study of air conditioner
Demonstration on:
     (a) Smithy operations, upsetting, swaging, setting down and bending. Example –

Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III   ELECTRICAL ENGINEERING PRACTICE   10
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power   factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

IV   ELECTRONICS ENGINEERING PRACTICE   13
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general   purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:
1.   Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2.   Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Puplishing House Pvt.Ltd, 2006.
3.   Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2007.
4.   Rajendra Prasad A. & Sarma P.M.M.S., "Workshop Practice", Sree Sai Publication, 2002.
5.   Kannaiah P. & Narayana K.L., "Manual on Workshop Practice", Scitech Publications, 1999.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes,
   plastic pipes, flexible pipes, couplings, unions, elbows, plugs and
   other fittings.   15 Sets.
2. Carpentry vice (fitted to work bench)   15 Nos.
3. Standard woodworking tools   15 Sets.
4. Models of industrial trusses, door joints, furniture joints   5 each
5. Power Tools: (a) Rotary Hammer   2 Nos
   (b) Demolition Hammer   2 Nos
   (c) Circular Saw   2 Nos
   (d) Planer   2 Nos
   (e) Hand Drilling Machine   2 Nos
   (f) Jigsaw   2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders   5 Nos.
2. Welding booth with exhaust facility   5 Nos.
3. Welding accessories like welding shield, chipping hammer,
   wire brush, etc.   5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other
   welding outfit.   2 Nos.

5. Centre lathe   2 Nos.
6. Hearth furnace, anvil and smithy tools   2 Sets.
7. Moulding table, foundry tools   2 Sets.
8. Power Tool: Angle Grinder   2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner   One each.

ELECTRICAL

1. Assorted electrical components for house wiring   15 Sets
2. Electrical measuring instruments   10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V)   1 No.
5. Power Tools: (a) Range Finder   2 Nos
               (b) Digital Live-wire detector   2 Nos

ELECTRONICS

1. Soldering guns   10 Nos.
2. Assorted electronic components for making circuits   50 Nos.
3. Small PCBs   10 Nos.
4. Multimeters   10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power
   supply

GE6163   **PHYSICS AND CHEMISTRY LABORATORY – I**   **L T P C**
                                                               0 0 2 1

PHYSICS LABORATORY – I

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.

5.   Determination of Young's modulus by Non uniform bending method
6.   Determination of specific resistance of a given coil of wire – Carey Foster's Bridge

OUTCOMES:
- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee's Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster's bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS
(Any FIVE Experiments)

1   Determination of DO content of water sample by Winkler's method.
2   Determination of chloride content of water sample by argentometric method.
3   Determination of strength of given hydrochloric acid using pH meter.
4   Determination of strength of acids in a mixture using conductivity meter.
5   Estimation of iron content of the water sample using spectrophotometer.
     (1,10- phenanthroline / thiocyanate method).
6   Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
7   Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:
1.   Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York 2001.
2.   Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore 1994.
3.   Jeffery G.H., Bassett J., Mendham J.and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4.   Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Iodine flask   -   30 Nos
2. pH meter   -   5 Nos
3. Conductivity meter   -   5 Nos
4. Spectrophotometer   -   5 Nos
5. Ostwald Viscometer   -   10 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (each 30 Nos.)

HS6251   **TECHNICAL ENGLISH II**   **L T P C**
                                                                                              3 1 0 4

OBJECTIVES:
- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I   **9+3**
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II   **9+3**
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III   **9+3**
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the

preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV   9+3
Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V   9+3
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
- speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
- listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:
1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008.
2. Muralikrishna, & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.
3. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
4. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009.
5. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites
1. http://www.englishclub.com
2. http://owl.english.purdue.edu

TEACHING METHODS:

*   Lectures
*   Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
*   Long presentations using visual aids
*   Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
*   Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%

> 3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
>> *   Project
>> *   Assignment
>> *   Report
>> *   Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.
*   ✓ Speaking assessment: Individual presentations, Group discussions
*   ✓ Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
*   ✓ Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
*   ✓ Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

End Semester Examination: 80%

OBJECTIVES:

* To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
* To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
* To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
* To make the student appreciate   the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I   VECTOR CALCULUS   9+3
Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT II   ORDINARY DIFFERENTIAL EQUATIONS   9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III   LAPLACE TRANSFORM   9+3
Laplace transform – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Transforms of unit step function and impulse functions – Transform of periodic functions. Inverse Laplace transform -Statement of Convolution theorem – Initial and final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV   ANALYTIC FUNCTIONS   9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = $z+k$, kz, $1/z$, z^2, e^z and bilinear transformation.

UNIT V   COMPLEX INTEGRATION   9+3
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor's and Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

* The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:
1.   Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi

Publications Pvt Ltd.,2011.

2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, 2011.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
3. Peter V. O'Neil," Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Sivarama Krishna Das P. and Rukmangadachari E., "Engineering Mathematics" Volume II, Second Edition, PEARSON Publishing, 2011.

PH6251	ENGINEERING PHYSICS – II	L T P C
		3 0 0 3

OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I   CONDUCTING MATERIALS   9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II   SEMICONDUCTING MATERIALS   9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration –– Hall effect –Determination of Hall coefficient – Applications.

UNIT III   MAGNETIC AND SUPERCONDUCTING MATERIALS   9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High T_c superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV   DIELECTRIC MATERIALS   9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius –

Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V   ADVANCED ENGINEERING MATERIALS   9
Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications

TOTAL: 45 PERIODS

OUTCOMES:
- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:
1.   Arumugam M., Materials Science. Anuradha publishers, 2010
2.   Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009

REFERENCES:
1.   Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
2.   Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.
3.   Mani P. Engineering Physics II. Dhanam Publications, 2011.
4.   Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.

CY6251   **ENGINEERING CHEMISTRY - II**   **L T P C**
                                                                                  3 0 0 3

OBJECTIVES:
- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I   WATER TECHNOLOGY   9
Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT II   ELECTROCHEMISTRY AND CORROSION   9
Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types-

chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III   ENERGY SOURCES   9
Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell- applications.

UNIT IV   ENGINEERING MATERIALS   9
Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V   FUELS AND COMBUSTION   9
Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS

OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:
1.   Vairam S, Kalyani P and SubaRamesh.,"Engineering Chemistry"., Wiley India PvtLtd.,New Delhi., 2011.
2.   DaraS.S,UmareS.S."Engineering Chemistry", S. Chand & Company Ltd., New Delhi , 2010.

REFERENCES:
1   Kannan P. and Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2.   AshimaSrivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
3.   RenuBapna and Renu Gupta., "Engineering Chemistry", Macmillan India Publisher Ltd., 2010.
4   Pahari A and Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010.

GE6251   **BASIC CIVIL AND MECHANICAL ENGINEERING**   **L T P C**
                                                                                                        4 0 0 4

OBJECTIVES
- To impart basic knowledge on Civil and Mechanical Engineering.
- To explain the materials used for the construction of civilized structures.
- To make the understand the fundamentals of construction of structure.
- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the R & AC system.

A – CIVIL ENGINEERING

UNIT I   SURVEYING AND CIVIL ENGINEERING MATERIALS   15
Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II   BUILDING COMPONENTS AND STRUCTURES   15
Foundations: Types, Bearing capacity – Requirement of good foundations.
Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

                                                                        TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III   POWER PLANT ENGINEERING   10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV   IC ENGINES   10
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM   10
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

                                                                        TOTAL: 30 PERIODS

OUTCOMES:
- Ability to explain the usage of construction material and proper selection of construction materials.
- Ability to design building structures.
- Ability to identify the components use in power plant cycle.
- Ability to demonstrate working principles of petrol and diesel engine.
- Ability to explain the components of refrigeration and Air conditioning cycle.

TEXT BOOKS:
1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.

REFERENCES:
1. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. 1999.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
3. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, 2000.
4. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

EE6201	**CIRCUIT THEORY**	**L T P C**
		3 1 0 4

OBJECTIVES:
- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To Phasor diagrams and analysis of three phase circuits

UNIT I   BASIC CIRCUITS ANALYSIS   12
Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC
**   AND AC CIRCUITS   12**
Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III   RESONANCE AND COUPLED CIRCUITS   12
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC CIRCUITS   12
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z,Y and h   parameters.

UNIT V   THREE PHASE CIRCUITS   12
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

OUTCOMES:
- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

TEXT BOOKS:
1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.

REFERENCES:
1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, 1996.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
4. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.

GE6262   **PHYSICS AND CHEMISTRY LABORATORY – II**   **L T P C**
                                                                             0 0 2 1

PHYSICS LABORATORY – II

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of Young's modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:
- The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.

5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:
- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1   Determination of alkalinity in water sample
2   Determination of total, temporary & permanent hardness of water by EDTA method
3   Estimation of copper content of the given solution by EDTA method
4   Estimation of iron content of the given solution using potentiometer
5   Estimation of sodium present in water using flame photometer
6   Corrosion experiment – weight loss method
7   Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8   Determination of CaO in Cement.

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:
1.   Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New York, 2001.
2.   Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry, LBS Singapore ,1994.
3.   Jeffery G.H, Bassett J., Mendham J. and Denny R.C., "Vogel's Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4.   Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, McMillan, Madras 1980
•   **Laboratory classes on alternate weeks for Physics and Chemistry.**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Potentiometer	-	5 Nos
2.	Flame photo meter	-	5 Nos
3.	Weighing Balance	-	5 Nos
4.	Conductivity meter	-	5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)

GE6263	COMPUTER PROGRAMMING LABORATORY	L T P C
		0 1 2 2

OBJECTIVES:

The Students should be made to

- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15

Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15

Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students should be able to:

- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

EE6211   **ELECTRIC CIRCUITS LABORATORY**   **L T P C**
                                                                            0 0 3 2

OBJECTIVES :

- To provide practical experience with simulation of electrical circuits and verifying circuit theorems.

LIST OF EXPERIMENTS
1. Experimental verification of Kirchhoff's voltage and current laws
2. Experimental verification of network theorems (Thevenin, Norton, Superposition and maximum power transfer Theorem).
3. Study of CRO and measurement of sinusoidal voltage, frequency and power factor.
4. Experiental determination of time constant of series R-C electric circuits.
5. Experimental determination of frequency response of RLC circuits.
6. Design and Simulation of series resonance circuit.
7. Design and Simulation of parallel resonant circuits.
8. Simulation of low pass and high pass passive filters.
9. Simulation of three phase balanced and unbalanced star, delta networks circuits.
10. Experimental determination of power in three phase circuits by two-watt meter method .
11. Calibration of single phase energy meter.
12. Determination of two port network parameters.

                                                                 TOTAL: 45 PERIODS

OUTCOMES :
- Ability to understand and apply circuit theorems and concepts in engineering applications.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1   Regulated Power Supply: 0 – 15 V D.C - 10 Nos / Distributed Power Source.
2   Function Generator (1 MHz) - 10 Nos.
3   Single Phase Energy Meter - 1 No.
4   Oscilloscope (20 MHz)   - 10 Nos.
5   Digital Storage Oscilloscope (20 MHz) – 1 No.
6   Circuit Simulation Software (5 Users) (Pspice / Matlab /other Equivalent software
          Package) with PC(5 Nos.) and Printer (1 No.)
7   AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
8   Single Phase Wattmeter – 3 Nos.
9   Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each - 6 Nos.
10   Circuit Connection Boards - 10 Nos.

   Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)

MA6351   TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS   L T P C
**   3 1 0 4**

OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I   PARTIAL DIFFERENTIAL EQUATIONS   9+3
Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange's linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II   FOURIER SERIES   9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9+3
Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

UNIT IV   FOURIER TRANSFORMS   9+3
Statement of Fourier integral theorem   – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V   Z - TRANSFORMS AND DIFFERENCE EQUATIONS   9+3
Z- transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

**   TOTAL (L:45+T:15): 60 PERIODS**

OUTCOMES:
- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS:
1.   Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2.   Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3.   Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.

REFERENCES:
1. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Datta K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

GE6351   **ENVIRONMENTAL SCIENCE AND ENGINEERING**   **L T P C**
                                                              3 0 0 3

OBJECTIVES:
To the study of nature and the facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   12
Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II   ENVIRONMENTAL POLLUTION   10
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water

quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III   NATURAL RESOURCES   10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV   SOCIAL ISSUES AND THE ENVIRONMENT   7
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.
Public awareness.

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT   6
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.

- Ignorance and incomplete knowledge has lead to misconceptions

- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :
1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :
1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

EE6301   **DIGITAL LOGIC CIRCUITS**   **LT P C**
                                                                               3 1 0 4
OBJECTIVES:

- To study various number systems , simplify the logical expressions using Boolean functions
- To study implementation of combinational circuits
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLCs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I   NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES   9
Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code0- Digital Logic Families ,comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II   COMBINATIONAL CIRCUITS   9
Combinational logic - representation of logic functions-SOP and POS forms, K-map representations-minimization using K maps - simplification and implementation of combinational logic - multiplexers and demultiplexers - code converters, adders, subtractors.

UNIT III   SYNCHRONOUS SEQUENTIAL CIRCUITS   9
Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV   ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE
                  LOGIC DEVICES   9
Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.

UNIT V   VHDL   9

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flipflops, FSM, Multiplexers /Demultiplexers).

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES:

1. Mandal "Digital Electronics Principles & Application, McGraw Hill Edu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL,Pearson,2013.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
5. Charles H.Roth,Jr,Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.
7. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 2013.
8. Botros, HDL Programming Fundamental, VHDL& Verilog, Cengage, 2013.

EC6202   ELECTRONIC DEVICES AND CIRCUITS   L T P C
**   3 1 0 4**

OBJECTIVES:

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

UNIT I   PN JUNCTION DEVICES   9

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes- Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II   TRANSISTORS   9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

UNIT III   AMPLIFIERS   9

BJT small signal model –   Analysis of CE, CB, CC amplifiers- Gain and frequency response –
MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response-
High frequency analysis.

UNIT IV   MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER   9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET
input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods,
power amplifiers –Types (Qualitative analysis).

UNIT V   FEEDBACK AMPLIFIERS AND OSCILLATORS   9

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback –
Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- To explain the structure of the basic electronic devices.
- To design applications using the basic electronic devices.

TEXT BOOKS:
1. David A. Bell ,"Electronic Devices and Circuits", Prentice Hall of India, 2004.
2. Sedra and smith, "Microelectronic Circuits " Oxford University Press, 2004.

REFERENCES:
1. Rashid, "Micro Electronic Circuits" Thomson publications, 1999.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic Devices and Circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical
   Instrumentation", CRC Press, 2004.

EE6303   LINEAR INTEGRATED CIRCUITS AND APPLICATIONS   L T P C
**   3 0 0 3**

OBJECTIVES:
- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL
- circuits, regulator Circuits, ADCs.

UNIT I   IC FABRICATION   9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching,
diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes,
capacitance, resistance and FETs.

UNIT II   CHARACTERISTICS OF OPAMP   9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNIT III   APPLICATIONS OF OPAMP   9

Instrumentation amplifier,   Log and Antilog Amplifiers, first and second order active filters, , comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV   SPECIAL ICs   9

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNIT V   APPLICATION ICs   9

IC voltage regulators –LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:
1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV Edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES:
1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition, 2012.

EI6301   **ELECTRICAL MEASUREMENTS**   **L T P C**
                                                                          3 1 0 4
OBJECTIVES:
- To introduce the meters used to measure current & voltage.
- To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
- To provide Elaborate discussion about potentiometer & instrument transformers.
- To provide Detailed study of resistance measuring methods.
- To provide Detailed study of inductance and capacitance measurement.

UNIT I   MEASUREMENT OF VOLTAGE AND CURRENT   9
Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction

type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

UNIT II MEASUREMENT OF POWER AND ENERGY 9
Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter– Phantom loading – Induction type kWh meter – Induction type energy meter – Calibration of wattmeter and Energy meter

UNIT III POTENTIOMETERS & INSTRUMENT TRANSFORMERS 9
DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Instrument Transformer:-C.T and P.T construction, theory, operation and characteristics.

UNIT IV RESISTANCE MEASUREMENT 9
Measurement of low, medium & high resistance – Ammeter, voltmeter method – Wheatstone bridge– Kelvin double bridge – Series and shunt type ohmmeter – High resistance measurement :-Loss of charge method, Megohm bridge method –Megger – Direct deflection methods – Price's guard-wire method – Earth resistance measurement.

UNIT V IMPEDANCE MEASUREMENT 9
A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Schering bridge – Anderson bridge –Hay's bridge- Campbell bridge to measure mutual inductance – Errors in A.C. bridge methods and their compensation – Detectors – Excited field – A.C. galvanometer – Vibration galvanometer

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Ability to understand and apply basic science, circuit theory, control theory and signal processing concepts to engineering problems.

TEXT BOOKS:
1. E.W. Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler & Co, 2001.
2. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi, 2010.
3. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010.

REFERENCES:
1. J.B.Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K.Kataria & Sons, Delhi, 2003.
2. S.K.Singh, 'Industrial Instrumentation and control', Tata McGraw Hill, 2nd edn., 2002.
3. Martin U. Reissland, 'Electrical Measurement – Fundamental Concepts and Applications', New Age International (P) Ltd., 2001.
4. R.B. Northrop, Introduction to Instrumentation and Measurements, Taylor & Francis, New Delhi, 2008.
5. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, Prentice Hall India, New Delhi, 2009.
6. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011.

EC6361   **ELECTRONICS LABORATORY**   **L T P C**
                                                                      0 0 3 2

OBJECTIVES:
To enable the students to understand the behavior of semiconductor device based on experimentation

LIST OF EXPERIMENTS:

1.   Characteristics of Semi conductor diode and Zener diode
2.   Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3.   Characteristics of JFET(Draw the equivalent circuit)
4.   Characteristics of UJT and generation of saw tooth waveforms
5.   Design and Frequency response characteristics of a Common Emitter amplifier
7.   Characteristics of photo diode & photo transistor, Study of light activated relay circuit
8.   Design and testing of RC phase shift, LC oscillators
9.   Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
10.   Differential amplifiers using FET
11.   Study of CRO for frequency and phase measurements
12.   Astable and Monostable multivibrators
13.   Realization of passive filters

                                                              TOTAL : 45 PERIODS
OUTCOMES:
• Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconducter devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo
   diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators   10
5. Regulated 3 output Power Supply 5, ± 15V   10
6. CRO   10
7. Storage Oscilloscope   1
8. Bread boards   10
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

EE6311   **LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY**   **L T P C**
                                                                                     0 0 3 2

OBJECTIVES:

Working Practice in simulators / CAD Tools / Experiment test bench to learn design, testing and characterizing of circuit behaviour with digital and analog ICs.

LIST OF EXPERIMENTS:

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.

2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa

3. Parity generator and parity checking

4. Encoders and Decoders

5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.

6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

7. Study of multiplexer and demultiplexer

8 Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.

9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.

10. Study of VCO and PLL ICs:

    i. Voltage to frequency characteristics of NE/ SE 566 IC.

    ii. Frequency multiplication using NE/SE 565 PLL IC.

                                                                       TOTAL : 45 PERIODS

OUTCOMES:

• Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

(3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variable Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	

6	Bread board	10	
7	Computer (PSPICE installed)	1	
Consumables (Minimum of 25 Nos. each)			
1	IC 741/ IC NE555/566/565	25	
2	Digital IC types	25	
3	LED	25	
4	LM317	25	
5	LM723	25	
6	ICSG3524 / SG3525	25	
7	Transistor – 2N3391	25	
8	Diodes,	25	IN4001,BY126
9	Zener diodes	25	
10	Potentiometer		
11	Step-down transformer	1	230V/12-0-12V
12	Capacitor		
13	Resistors 1/4 Watt Assorted	25	
14	Single Strand Wire		

MA6459   **NUMERICAL METHODS**   **L T P C**
                                                                  3 1 0 4

OBJECTIVES:
* This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

UNIT I   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   10+3
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II   INTERPOLATION AND APPROXIMATION   8+3
Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III   NUMERICAL DIFFERENTIATION AND INTEGRATION   9+3
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV   INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL
                     EQUATIONS   9+3
Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT V   BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL
                     EQUATIONS   9+3
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:
1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.

REFERENCES:
1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.

CS6456   **OBJECT ORIENTED PROGRAMMING**   **L T P C**
                                                                                 3 0 0 3

OBJECTIVES:
•   To get a clear understanding of object-oriented concepts.
•   To understand object oriented programming through C++.

UNIT I   OVERVIEW   9
Why Object-Oriented Programming in C++ - Native Types and Statements –Functions and Pointers-
Implementing ADTs in the Base Language.

UNIT II   BASIC CHARACTERISTICS OF OOP   9
Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data
abstraction: Iterators and Containers.

UNIT III   ADVANCED PROGRAMMING   9
Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.

UNIT IV   OVERVIEW OF JAVA   9
Data types, variables and arrays, operators, control statements, classes, objects, methods –
Inheritance

UNIT V   EXCEPTION HANDLING   9
Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output

TOTAL : 45 PERIODS

OUTCOMES:
• Gain the basic knowledge on Object Oriented concepts.
• Ability to develop applications using Object Oriented Programming Concepts.
• Ability to implement features of object oriented programming to solve real world problems.

TEXT BOOKS:
1. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education Asia, 2003.
2. H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited,
    2003.

REFERENCES:
1. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002
2. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2004.
3. Stanley B. Lippman and Josee Lajoie , "C++ Primer", Pearson Education, 2003.
4. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.

EI6401   **TRANSDUCER ENGINEERING**   **L T P C**
                                                                           3 0 0 3

OBJECTIVES:
- To understand how physical quantities are measured and how they are converted to electrical or other forms.
- To have an adequate knowledge in resistance, transducers.
- To develop the knowledge of inductance and capacitance transducers.
- To study the characteristics of Transducers.
- To impart knowledge on various types of transducers

UNIT I   SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS   9
Units and standards – Calibration methods – Static calibration – Classification of errors :-   Limiting error and probable error – Error analysis :– Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

UNIT II   CHARACTERISTICS OF TRANSDUCERS   9
Static characteristics: – Accuracy, precision, resolution, sensitivity, linearity, span and range -Dynamic characteristics: – Mathematical model of transducer – Zero, I and II order transducers - Response to impulse, step, ramp and sinusoidal inputs.

UNIT III   VARIABLE RESISTANCE TRANSDUCERS   9
Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezoresistive sensor and humidity sensor.

UNIT IV   VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS   9
Induction potentiometer – Variable reluctance transducers – EI pick up – Principle of operation, construction details, characteristics and applications of LVDT –Capacitive transducer and types – Capacitor microphone – Frequency response.

UNIT V   OTHER TRANSDUCERS   9
Piezoelectric transducer - Hall Effect transducer – Magneto elastic sensor- Digital transducers – Smart sensors - Fibre optic sensors- Film sensors-Introduction to MEMS and Nano sensors.

                                                                      TOTAL : 45 PERIODS
OUTCOMES:
- Ability to model and analyze transducers.

TEXT BOOKS:
1. Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge, 2003.
2. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.
3. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.

REFERENCES:
1. John P. Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2000.
2. Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. W.Bolton, Engineering Science, Elsevier Newnes, Fifth edition, 2006.
4. Ramón Pallás-Areny, John G. Webster, Sensors and Signal Conditioning, Wiley-Interscience 2nd Edition, 1991.
5. Bela G.Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, 4th

Edition, Vol. 1, ISA/CRC Press, 2003.

6.   Ian Sinclair, Sensors and Transducers, 3rd Edition, Elsevier, 2012.

EE6403   **DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING**   **L T P C**
                                                                            3 0 0 3

OBJECTIVES:

- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I   INTRODUCTION   9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II   DISCRETE TIME SYSTEM ANALYSIS   9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform,application to discrete systems - Stability analysis, frequency response – Convolution – Discrete TimeFourier transform , magnitude and phase representation.

UNIT III   DISCRETE FOURIER TRANSFORM & COMPUTATION   9

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT IV   DESIGN OF DIGITAL FILTERS   9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. Analog filter design – Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation - mWarping, pre warping.

UNIT V   DIGITAL SIGNAL PROCESSORS   9

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSProcessors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1.   J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms

and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning, 2014.

REFERENCES:

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH, 2013.
2. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010.
3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. Sen M.kuo, woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 2013.
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing, Cambridge, 2012.
6. Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing", Wiley, 2013.

EI6402   **ELECTRICAL MACHINES**   **L T P C**
                                                                                 3 1 0 4

OBJECTIVES:
- To introduce the principles of operations of DC machines as motor and generator
- To introduce the principles of operations of Transformers
- To introduce the principles of operations of Induction machines
- To introduce the principles of operations of Synchronous machines
- To introduce other special machines

UNIT I   D.C. MACHINES   9
D.C. Machines – Principle of operation and construction of motor and generator – torque and EMI equation – Various excitation schemes – Characteristics of Motor and Generator – Starting, Speed control and braking of D.C. Motor

UNIT II   TRANSFORMERS   9
Principle , Construction and Types of Transformer - EMF equation - Equivalent circuits - Phasor diagrams - Regulation and efficiency of a transformer-three phase transformer Connection

UNIT III   SYNCHRONOUS MACHINES   9
Principle of Operation, type - EMF Equation and Phasor diagrams - Synchronous motor-Rotating Magnetic field Starting Methods , Torque V-Curves, inverted – V curves

UNIT IV   THREE PHASE INDUCTION MOTORS   9
Induction motor-principle of operation, Types - Torque-slip characteristics - Starting methods and Speed control of induction motors.

UNIT V   SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES   9
Types of single phase induction motors –Double field revolving theory- Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor.

                                                            TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. B.S.Guru and H.R.Hiziroglu, "Electric Machinery and Transformer', Oxford university Press 2007.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
3. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.

REFERENCES:
1. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill, Singapore, 2000.
3. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
4. M.S. Sarma and M.K.Pathak, "Electric Machines", Cengage Learning, 2012.
5. C.A.Gross, "Electric Machines", CRC Press 2010.

EI6403   APPLIED THERMODYNAMICS AND FLUID DYNAMICS   L T P C
3 1 0 4

OBJECTIVES:
- To explain the various laws of thermodynamics
- To explain the operation of boiler
- To explain the different types of pumps and turbines
- To explain the concept of flow through the closed conduit.

UNIT I   LAWS OF THERMODYNAMICS AND BASIC IC ENGINE CYCLES   9
Systems zeroth law, first law of thermodynamics – concept of internal energy and enthalpy applications to closed and open systems – second law of thermodynamics – concept of entropy – clausius inequality and principles of increase in irreversible processes. Basic IC engine and gas turbine cycles-- single and multistage reciprocating compressors.

UNIT II   THERMODYNAMICS OF REFRIGERATORS AND PUMPS   9
Properties of steam – Ranking cycle—Boilers and its accessories– Basic thermodynamics ofrefrigerators and heat pumps.-Basics of Heat transfer

UNIT III   BASIC CONCEPT OF FLUID MECHANICS &FLOW OF FLUIDS   9
Introduction – classification – types of fluids – properties – laws of pressure – atmospheric, gauge, absolute pressure, pressure measurement – manometers – mechanical gauges. Types of fluid flow –

velocity – rate equation of continuity – energy of a liquid in motion – headof a liquid – Bernoulli's theorem – orifice and mouthpiece.

UNIT IV DIMENSIONAL AND MODEL ANALYSIS 9
Introduction – dimensions – dimensional analyses – Rayleigh's and Buckingham's method- similitude - dimensionless numbers and their significance – similarity laws – model studies.

UNIT V PUMPS AND TURBINES 9
Introduction – types of pumps – reciprocating pump – construction details – co-efficient of discharge – slip – power required – centrifugal pump – classification – working principle –specific speed – turbines– classification – working principle.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. Nag, P.K., Engineering Thermodynamics, Tata McGraw-Hill Co. Ltd., 2007.
2. BANSAL.R.K,'Fluid Mechanics and Hydraulic Machines', Laxmi Publications' (P) Ltd, 2005.
3. Yunus A. Çengel, Michael A. Boles, Thermodynamics: An Engineering Approach, McGraw- Hill Higher Education, 2006.

REFERENCES:
1. Reynolds, Thermodynamics, Int. Student Edition, McGraw-Hill Co. Ltd., 1990.
2. Ramalingam. K.K." Thermodynamics", Sci-Tech Publications, 2006.
3 Holman. J.P, 3rd Ed, McGraw-Hill, 2007.
4. Shames, I.H., 'Mechanics of fluids', Kogakusha, Tokyo, 1998.
5. Kumar, K.L., 'Fluid Mechanics', Eurasia publishers, 1990.

CS6461   **OBJECT ORIENTED PROGRAMMING LABORATORY**   **L T P C**
                                                                         0 0 3 2

OBJECTIVES:
- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

LIST OF EXPERIMENTS:
C++:
1. program using functions
   - functions with default arguments
   - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
   - classes with primitive data members,
   - classes with arrays as data members
   - classes with pointers as data members
   - classes with constant data members

- classes with static member functions
3. compile time polymorphism
  - operator overloading
  - function overloading
4. run time polymorphism
  - inheritance
  - virtual functions
  - virtual base classes
  - templates
5. file handling
  - sequential access
  - random access

JAVA:
6. simple java applications
  - for understanding references to an instant of a class
  - handling strings in JAVA
7. simple package creation
  - developing user defined packages in java
8. interfaces
  - developing user defined interfaces
  - use predefined interfaces
9. threading
  - creation of threading in java applications
  - multi threading
10. exception handling mechanism in java
  - handling predefined exceptions
  - handling user defined exceptions

TOTAL :45 PERIODS

OUTCOMES:
• Gain the basic knowledge on Object Oriented concepts.
• Ability to develop applications using Object Oriented Programming Concepts.
• Ability to implement features of object oriented programming to solve real world problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ complier   30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

EI6411   **ELECTRICAL MACHINES LABORATORY**   **L T P C**
                                                                          0 0 3 2

OBJECTIVES:

To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response. To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

LIST OF EXPERIMENTS:

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne's test
6. speed control of D.C. shunt motor.
7. Load test on single phase transformer
8. open circuit and short circuit tests on single phase transformer(Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on Three phase induction motor.
12. Study of Starters

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. Single Phase Transformer – 4 nos
3. DC Series Motor with Loading Arrangement – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 1 No.
6. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled With DC Shunt Generator – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank. – 2 nos
13. SPST switch – 2 nos

EE6502   **MICROPROCESSORS AND MICROCONTROLLERS**   **L T P C**
                                                                      3 0 0 3

OBJECTIVES:

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

UNIT I   8085 PROCESSOR   9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II   PROGRAMMING OF 8085 PROCESSOR   9

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III   8051 MICRO CONTROLLER   9

Hardware Architecture, pintouts – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts-Comparison to Programming concepts with 8085.

UNIT IV   PERIPHERAL INTERFACING   9

Study on need, Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279 ,- A/D and D/A converters &Interfacing with 8085& 8051

UNIT V   MICRO CONTROLLER PROGRAMMING & APPLICATIONS   9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises-key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.

3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford, 2013.
3. Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

IC6501	CONTROL SYSTEMS	LT P C
		3 1 0 4

OBJECTIVES:
- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and   study the effect of state feedback

UNIT I   SYSTEMS AND THEIR REPRESENTATION   9
Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II   TIME RESPONSE   9
Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effects of P, PI, PID modes of feedback control –Time response analysis.

UNIT III   FREQUENCY RESPONSE   9
Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Effect of Lag, lead and lag-lead compensation on frequency response- Analysis.

UNIT IV   STABILITY AND COMPENSATOR DESIGN   9
Characteristics equation – Routh Hurwitz criterion – Nyquist stability criterion- Performance criteria – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

UNIT V STATE VARIABLE ANALYSIS 9

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, theory control theory Signal processing and apply them to electrical engineering problems.

TEXT BOOKS:

1. M. Gopal, 'Control Systems, Principles and Design', 4th Edition, Tata McGraw Hill, New Delhi, 2012.
2. S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
3. Dhanesh. N. Manik, Control System, Cengage Learning, 2012.

REFERENCES:

1. Arthur, G.O.Mutambara, Design and Analysis of Control; Systems, CRC Press, 2009.
2. Richard C. Dorf and Robert H. Bishop, " Modern Control Systems", Pearson Prentice Hall, 2012.
3. Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010.
4. K. Ogata, 'Modern Control Engineering', 5th edition, PHI, 2012.
5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.
6. S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

EE6503 **POWER ELECTRONICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWERSEMI-CONDUCTOR DEVICES 9

Study of switching devices, Diode, SCR,TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II   PHASE-CONTROLLED CONVERTERS   9

2-pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance–– Gate Circuit Schemes for Phase Control–Dual converters.

UNIT III   DC TO DC CONVERTER   9

Step-down and step-up chopper-control strategy–Forced commutated chopper–Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV   INVERTERS   9

Single phase and three phase voltage source inverters(both120^0modeand180^0mode)–Voltage& harmonic control--PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

UNIT V   AC TO AC CONVERTERS   9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control   -single phase and three phase cyclo converters –Introduction to Matrix converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil,' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian   reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press,2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins,' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition,2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, McGraw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," McGraw Hill India, 2013.

EI6501   **ANALYTICAL INSTRUMENTS**   **L T P C**
                                                                                 3 0 0 3

OBJECTIVES:
- To understand various techniques and methods of analysis which occur in the various regions of the spectrum.
- To study important methods of analysis of industrial gases.
- To understand the important radio chemical methods of analysis.

UNIT I   COLORIMETRY AND SPECTROPHOTOMETRY   9
Spectral methods of analysis– Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Single and double beam instruments , Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers – Fluorescence spectrophotometer

UNIT II   CHROMATOGRAPHY   9
Different techniques – Techniques by chromatographic bed shape- Column chromatography-Planer Chromatography-Paper Chromatography-Thin layer Chromatography-Applications - Techniques by physical state of mobile phase- Gas chromatography – Sources- Detectors – Liquid chromatographs – sources- detectors- Applications – High-pressure liquid chromatographs – sources-detectors-Applications- Techniques by separation mechanism-Ion exchange chromatography-size-exclusion chromatography-Applications

UNIT III   INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING
**   INSTRUMENTS   9**
Types of gas analyzers – Oxygen, NO_2 and H_2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

UNIT IV   PH METERS AND DISSOLVED COMPONENT ANALYZERS   9
Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

UNIT V   NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES   9
NMR :– Basic principles , NMR spectrometer and Applications - Electron spin Resonance spectroscopy: – Basic principles, Instrumentation and applications. Scanning Electron Microscope (SEM) :- Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM) :– Basic principles – Instrumentation and applications. Mass spectrometers :– Different types and Applications.

                                                                          TOTAL : 45 PERIODS
OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries

TEXT BOOKS:
1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2nd edition, 2006.
2. G.W. Ewing, Instrumental Methods of Analysis, Mc Graw Hill, 2004.
3. Liptak, B.G., Process Measurement and Analysis, CRC Press, 2005.

REFERENCES:
1. Braun, R.D., Introduction to Instrumental Analysis, Mc Graw – Hill, Singapore, 2006.
2. H.H.Willard, L.L.Merritt, J.A.Dean, F.A.Settle, Instrumental methods of analysis, CBS publishing & distribution, 1995.
3. James keeler ; Understanding NMR Spectroscopy, Second Edition John Wiley & Sons, 2010.
4. John H.Nelson , Nuclear Magnetic Resonance Spectroscopy, Prentice Hall/Pearson Education, 2003.
5. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007.

EI6502   **INDUSTRIAL INSTRUMENTATION – I**   **L T P C**
                                                                                        3 0 0 3

OBJECTIVES:
- To introduce the measurement techniques of force, torque and speed
- To introduce the measurement techniques of acceleration, Vibration and density
- To introduce the pressure measurement techniques
- To introduce the temperature measurement techniques
- To introduce the high temperature measurement techniques

UNIT I   MEASUREMENT OF FORCE, TORQUE AND SPEED   9
Electric balance - Different types of load cells - Hydraulic, Pneumatic, strain gauge-Magnetoelastic and Piezoelectric load cells - Different methods of torque measurement:- Strain gauge-Relative angular twist-Speed measurement:-Capacitive tacho-Drag cup type tacho-D.C and A.C tachogenerators - Stroboscope.

UNIT II   MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY   9
Accelerometers :- LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer - Vibration sensor - Calibration of vibration pickups - Units of density and specific gravity - Baume scale and API scale - Pressure type densitometers - Float type densitometers - Ultrasonic densitometer - gas densitometer.

UNIT III   PRESSURE MEASUREMENT   9
Units of pressure - Manometers, different types, Elastic type pressure gauges, Bourdon tube, bellows and diaphragms - Electrical methods:- Elastic elements with LVDT and strain gauges - Capacitive type pressure gauge - Piezo resistive pressure sensor-Resonator pressure sensor - Measurement of vacuum-McLeod gauge-Thermal conductivity gauge-Ionization gauges - Cold cathode type and hot cathode type - calibration of pressure gauges - Dead weight tester.

UNIT IV   TEMPERATURE MEASUREMENT - I   9
Definitions and standards - Primary and secondary fixed points - Calibration of thermometers - Different types of filled in system thermometers - Sources of errors in - filled in systems and their compensation - Bimetallic thermometers - RTD - characteristics and signal conditioning-3 lead and 4 lead RTDs - Thermistors.

UNIT V   TEMPERATURE MEASUREMENT - II   9
Thermocouples - Laws of thermocouple - Fabrication of industrial thermocouples - Signal conditioning for thermocouple - isothermal block reference junctions - Commercial circuits for cold

junction compensation - Response of thermocouple - Special techniques for measuring high temperature using thermocouple - Radiation fundamentals - Radiation methods of temperature measurement - Total radiation pyrometers - Optical pyrometers - Two colour radiation pyrometers - Fiber optic sensor for temperature measurement.

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries

TEXT BOOKS:
1. Doebellin, E.O.and Manik D.N., Measurement systems Application and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd, 2007.
2. Jones. B.E, Instrument Technology, Vol.2, Butterworth-Heinemann, International Edition, 2003.
3. A. K. Sawhney, Puneet Sawhney Course in Mechanical Measurements and Instrumentation and Control Dhanpat Rai & Sons, New Delhi, 1997.

REFERENCES:
1. Liptak, B.G., Instrumentation Engineers Handbook (Measurement), CRC Press, 2005
2. Patranabis,D., Principles of Industrial Instrumentation, 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
3. Eckman D.P., Industrial Instrumentation, Wiley Eastern Limited, 1990.
4. S.K.Singh., Industrial Instrumentation and Control, 3rd Edition, Tata McGraw - Hill Education, 2008.
5. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.

EE6612   MICROPROCESSORS AND MICROCONTROLLERS LABORATORY   LT P C
0 0 3 2

OBJECTIVES:
To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   - (i) Ascending / Descending order, Maximum / Minimum of numbers
   - (ii) Programs using Rotate instructions
   - (iii) Hex / ASCII / BCD code conversions.

3. Interface Experiments: with 8085
   (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
   (i) Conditional jumps, looping

(ii) Calling subroutines.
9.. Programming I/O Port 8051
   (i) study on interface with A/D & D/A
   (ii) study on interface with DC & AC motor .
10. Mini project development with processors.

<div align="right">**TOTAL: 45 PERIODS**</div>

OUTCOMES:
- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SI.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface board	5
4.	8251 Interface board	5
5.	8259 Interface board	5
6.	8279 Keyboard / Display Interface board	5
7.	8254 timer counter	5
8.	ADC and DAC card	5
9.	AC & DC motor with Controller	5
10.	Traffic Light Control System	5

EI6511   **TRANSDUCERS AND MEASUREMENTS LABORATORY**   **L T P C**
                                                                         0 0 3 2

OBJECTIVES:
The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also then expertise in handling the instruments involved.

LIST OF EXPERIMENTS:
1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Characteristics of Strain gauge and Load cell.
3. Characteristics of LVDT, Hall Effect transducer and Photoelectric tachometer.
4. Characteristics of LDR, thermistor and thermocouple.
5. Step response characteristic of RTD and thermocouple.
6. Temperature measurements using RTD with three and four leads.
7. Fiber optic transducer for temperature or pressure measurement.
8. Wheatstone and Kelvin's bridge for measurement of resistance.
9. Schering Bridge for capacitance measurement and Anderson Bridge for inductance measurement.
10. Calibration of Single-phase Energy meter and wattmeter.
11. Calibration of Ammeter and Voltmeter using Student type potentiometer.
12. Design and calibration of series and shunt type ohmmeters.
13. One or two experiments beyond syllabus.

A separate laboratory manual incorporating Aim, apparatus required, circuit Diagram, graph, Result for each experiment has to be developed by the Department and given to the students

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to model and analyze transducers.
- Ability to review, prepare and present technological developments

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Potentiometer – Linear displacement transducer kit	– 1 No
Regulated power supply	– 8 No
FET voltmeter	– 1 No
Strain gauge and Load cell kit.	– 1 No
Variable power supply	– 1 No
Loads for measurement	– one set
LVDT trainer kit	– 1 No.
Hall effect characteristics trainer	– 1 No.
Speed control trainer kit	– 1 No.
Multimeter	– 2 No.
Photo conductive trainer kit	– 1 No.
Thermistor Trainer kit	– 1 No.
Heater	– 1 No.
Thermistor	– 1 No.
Thermometer	– 1 No.
Thermocouple trainer kit	– 1 No.
Thermocouple and RTD trainer kit	– 1 No
Thermocouple and RTD sensors	– 1 No.
I/P trainer kit	– 1 No.
Pressure source	– 1 No.
Control valve etc	– 1 No.
Galvanometer	– 2 No.
Bread board	– 5 No.
Decade resistance box	– 5 No.
Multimeter	– 3 No.
Fixed resistance	– 1 No.
Unknown resistors	– 1 No.
Decade Capacitance box	– 1 No.
CRO	– 3 No.
Function Generator	– 1 No.
Decade Inductance box	– 1 No.
Wattmeter	– 3 No.
Voltmeter	– 7 No.
Ammeter	– 4 No.
Resistive load	– 1 No.
Standard ammeter	– 1 No.
Standard voltmeter	– 1 No.
Auto transformer	– 1 No.
Ohmmeter (Analog Multimeter)	– 1 No.
Energy meter	– 1 No.
Fibre optic transducer	– 1 No.

GE6674   **COMMUNICATION AND SOFT SKILLS- LABORATORY BASED**   **L T P C**
                                                                               0 0 4 2

OBJECTIVES:
To enable learners to,
- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I   LISTENING AND SPEAKING SKILLS   12
Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II   READING AND WRITING SKILLS   12
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III   ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND
                 PLACEMENTS   12
International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV   INTERVIEW SKILLS   12
Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V   SOFT SKILLS   12
Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership straits-team work- career planning - intercultural communication- creative and critical thinking

                                                                 TOTAL: 60 PERIODS

Teaching Methods:
1. To be totally learner-centric with minimum teacher intervention as the course   revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for graining proficiency and better participation in the class.

Lab Infrastructure:

S. No.	Description of Equipment (minimum configuration)	Qty Required
1	**Server** • PIV System • 1 GB RAM / 40 GB HDD • OS: Win 2000 server • Audio card with headphones • JRE 1.3	1 No.
2	**Client Systems** • PIII or above • 256 or 512 MB RAM / 40 GB HDD • OS: Win 2000 • Audio card with headphones • JRE 1.3	60 Nos.
3	Handicam	1 No.
4	Television 46"	1 No.
5	Collar mike	1 No.
6	Cordless mike	1 No.
7	Audio Mixer	1 No.
8	DVD recorder/player	1 No.
9	LCD Projector with MP3/CD/DVD provision for Audio/video facility	1 No.

Evaluation:
Internal: 20 marks
Record maintenance: Students should write a report on a regular basis on the activities conducted, focusing on the details such as the description of the activity, ideas emerged, learning outcomes and so on. At the end of the semester records can be evaluated out of 20 marks.
External: 80 marks

Online Test	- 35 marks
Interview	- 15 marks
Presentation	- 15 marks
Group Discussion	- 15 marks

Note on Internal and External Evaluation:
1. Interview – mock interview can be conducted on one-on-one basis.
2. Speaking **–** example for role play:
    a. Marketing engineer convincing a customer to buy his product.
    b. Telephonic conversation- fixing an official appointment / placing an order / enquiring and so on.
3. Presentation – should be extempore on simple topics.
4. Discussion – topics of different kinds; general topics, and case studies.

OUTCOMES:
At the end of the course, learners should be able to
• Take international examination such as IELTS and TOEFL
• Make presentations and Participate in Group Discussions.
• Successfully answer questions in interviews**.**

REFERENCES:

1. **Business English Certificate Materials,** Cambridge University Press.
2. **Graded Examinations in Spoken English and Spoken English for Work** downloadable materials from Trinity College, London.
3. **International English Language Testing System** Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on **Managing Time and Stress.**
5. **Personality Development** (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. **"Developing Soft Skills"** 4th edition, New Delhi: Pearson Education, 2009.

Web Sources:

http://www.slideshare.net/rohitjsh/presentation-on-group-discussion

http://www.washington.edu/doit/TeamN/present_tips.html

http://www.oxforddictionaries.com/words/writing-job-applications

http://www.kent.ac.uk/careers/cv/coveringletters.htm

http://www.mindtools.com/pages/article/newCDV_34.htm

EI6601   **MODERN ELECTRONIC INSTRUMENTATION**   **L T P C**
                                                                           3 0 0 3

OBJECTIVES:

- To introduce different types of electronic voltmeters and their applications.
- To provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- To introduce different types of waveform generators and analyzers and their applications.
- To educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
- To give exposure to telemetry, modulation techniques and multiplexing.

UNIT I   ELECTRONIC INSTRUMENTS   9
Electronic Voltmeter and their advantages – Types, Differential amplifier, source follower, rectifier – Truerms reading voltmeter – Electronic multimeter and ohmmeter – Current measurement – Power measurement - Microprocessor based DMM with auto ranging and self diagnostic features

UNIT II   CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS   9
General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer

UNIT III   WAVEFORM GENERATORS   9
Wien's bridge and phase shift oscillators – Hartley and crystal oscillators – Square wave and pulse generators – Triangular wave-shape generator - Signal and function generators – Q meter – Electronic Counters

UNIT IV   VIRTUAL INSTRUMENTATION   9
Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation -

VI programming techniques – DAQ cards for VI applications – DAQ modules with serial communication

UNIT V TELEMETRY 9

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai and Co, New Delhi, 2010.
2. Jerome J., Virtual Instrumentation using Lab VIEW, Prentice Hall India Private Ltd., New Delhi, 2010.
3. N. Mathivanan , PC based Instrumentation , Prentice Hall India Private Ltd., New Delhi, 2007.

REFERENCES:

1. David A Bell, " Electronic Instrumentation and Measurements", Ox for University Press, 2013.
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India Private Ltd., New Delhi, 2010.
3. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010.
4. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011.
5. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, Prentice Hall India, New Delhi, 2009.
6. Sanjay Gupta, Virtual Instrumentation using Lab view, Tata McGraw-Hill Education, 2010.

EI6602 **PROCESS CONTROL** **L T P C**
3 1 0 4

OBJECTIVES:

- To introduce dynamics of various processes
- To educate on the effect of various control actions
- To impart knowledge on the final control elements
- To introduce the evaluation criteria and tuning techniques of controllers
- To introduce the concept of multi loop control techniques

UNIT I PROCESS DYNAMICS 9

Need for process control – Mathematical model of Flow, Level, Pressure and Thermal processes – Interacting and non-interacting systems – Degrees of freedom – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems.

UNIT II   CONTROL ACTIONS   9
Characteristic of on-off, proportional, single speed floating, integral and derivative controllers – P+I, P+D and P+I+D control modes – Electronic PID controller – Auto/manual transfer - Reset windup – Practical forms of PID Controller.

UNIT III   FINAL CONTROL ELEMENTS   9
I/P converter - Pneumatic and electric actuators – Valve Positioner – Control Valves – Characteristic of Control Valves:- Inherent and Installed characteristics – Modeling of pneumatic control valve – Valve body:-Commercial valve bodies – Control valve sizing – Cavitation and flashing – Selection criteria.

UNIT IV   CONTROLLER TUNING   9
Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio - Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method – Determination of optimum settings for mathematically described processes using time response and frequency response approaches – Auto tuning.

UNIT V   MULTILOOP CONTROL   9
Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Examples from distillation column and boiler systems – IMC– Model Predictive Control – Adaptive control – P&ID diagram.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
- Ability to understand and analyse process control engineering problems.

TEXT BOOKS:
1. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.
2. Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005.
3. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003.

REFERENCES:
1. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw - Hill International Edition, 2004.
2. D. P. Eckman, "Automatic Process control", 7th Edition, John Wiley, New York, 1990.
3. Considine, D.M., Process Instruments and *Controls* Handbook, Second Edition, McGraw, 1999.
4. Bela.G.Liptak., "Process Control and Optimization"., Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
5. Curtis D. Johnson Process Control Instrumentation Technology, 8th Edition, Pearson, 2006.

EI6603   **INDUSTRIAL INSTRUMENTATION – II**   **L T P C**
                                                                            3 0 0 3

OBJECTIVES:
- To introduce variable head type flow meters
- To introduce quantity meters , air flow meters and mass flow meters
- To educate on electrical type flow meters
- To educate on the level measurement techniques
- To educate on Viscosity, Humidity and Moisture content

UNIT I   VARIABLE HEAD TYPE FLOWMETERS   9
Expression for flow rate through restriction(compressible and incompressible flow) -Orifice plate –
different types of orifice plates – Cd variation – pressure tappings – Venturi tube – Flow nozzle – Dall
tube – Pitot tube –combined pitot tube - averaging pitot tube – installation and applications of head
flow meters

UNIT II   QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS   9
Positive displacement flow meters: – Nutating disc, Reciprocating piston and Oval gear flow meters –
Inferential meter – Turbine flow meter – Variable Area flow meter:– Rotameter –theory,
characteristics, installation and applications – Mass flow meter :– Angular momentum – Thermal,
Coriolis type mass flow meters – Calibration of flow meters: – Dynamic weighing method

UNIT III   ELECTRICAL TYPE FLOW METERS   9
Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser
Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of
flow meter – Open channel flow measurement – Solid flow rate measurement

UNIT IV   LEVEL MEASUREMENT   9
Level measurement: – Float gauges - Displacer type – D/P methods -Bubbler system-Load cell –
Electrical types – Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge –
Boiler drum level measurement :– Differential pressure method and Hydrastep method -Solid level
measurement

UNIT V   MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE   9
Viscosity – Saybolt viscometer-Rotameter type viscometer – Consistency meters – Humidity - Dry and
wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type
dew meter – Moisture measurement in solids-Conductivity **sensor-Microwave and IR sensors.**

                                                                TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various
  industries.

TEXT BOOKS:
1. Doebelin, E.O.and Manik,D.N., Measurement Systems Application and Design, Special Indian
   Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.
2. Patranabis, D. Principles of Industrial Instrumentation, 3rd Edition, Tata McGraw Hill, New Delhi,
   2010.
3. David W. Spitzer, Industrial Flow Measurement; ISA-The Instrumentation, Systems, and
   Automation Society, 01-Jan-2005.

REFERENCES:
1. Liptak, B.G., Instrumentation Engineers Handbook (Measurement), CRC Press, 2005.
2. Singh,S.K., Industrial Instrumentation and Control, Tata McGrawHill Education Pvt. Ltd., New Delhi, 2009.
3. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
4. A. K. Sawhney, Puneet Sawhney Course in Mechanical Measurements and Instrumentation and Control Dhanpat Rai & Sons, New Delhi, 1997.
5. Eckman, D.P., " Industrial Instrumentation", Wiley Eastern Limited, 1990.
6. R.P. Benedict Fundamentals of Pressure and Flow Measurements, , John Wiley & Sons, Inc. New York, 1969.

EC6651   **COMMUNICATION ENGINEERING**   **LT P C**
                                                                     3 0 0 3

OBJECTIVES:
- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I   ANALOG COMMUNICATION   9
AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II   DIGITAL COMMUNICATION   9
Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III   SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)   9
Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV   MULTIPLE ACCESS TECHNIQUES   9
SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits) :

UNIT V   SATELLITE, OPTICAL FIBER – POWERLINE, SCADA   9
Orbits : types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Taub & Schiling "Principles of Communication Systems" Tata McGraw hill 2007.
2. J.Das "Principles of Digital Communication" New Age International, 1986.

REFERENCES:

1. Kennedy and Davis "Electronic Communication Systems" Tata McGraw hill, 4th Edition, 1993.
2. Sklar "Digital Communication Fundamentals and Applications" Pearson Education, 2001.
3. Bary le, Memuschmidt, Digital Communication, Kluwer Publication, 2004.
4. B.P.Lathi "Modern Digital and Analog Communication Systems" Oxford University Press, 1998.

EE6602	EMBEDDED SYSTEMS	LT P C
		3 0 0 3

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool

UNIT I   INTRODUCTION TO EMBEDDED SYSTEMS   9

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II   EMBEDDED NETWORKING   9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III   EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT   9

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV   RTOS BASED EMBEDDED SYSTEM DESIGN   9

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, чC/OS-II, RT Linux.

UNIT V   EMBEDDED SYSTEM APPLICATION DEVELOPMENT   9
Case Study of Washing Machine- Automotive Application- Smart card System Application,.

TOTAL: 45 PERIODS

OUTCOMES:

• Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:
1. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons, 2010.
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013.

REFERENCES:
1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD, 2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

EI6611   **INDUSTRIAL INSTRUMENTATION LABORATORY**   **L T P C**
                                                                               0 0 3 2
OBJECTIVES:
The aim of this lab is to impart an adequate knowledge and expertise to handle equipment generally available in an industry.

LIST OF EXPERIMENTS:
1. Discharge coefficient of orifice plate
2. Calibration of pressure gauge
3. Torque measurement
4. Viscosity measurement
5. Vacuum pressure measurement
6. Level measurement using d/p transmitter and capacitance based level measurement.
7. UV – Visible spectrophotometer
8. IR spectrophotometer
9. pH meter standardization and measurement of pH values of solutions
10. Measurements of conductivity of test solutions.
11. ECG measurement
12. Pulse rate measurement
13. One or two experiments beyond syllabus

A separate laboratory manual incorporating Aim, apparatus required, circuit Diagram, graph, Result for each experiment has to be developed by the Department and given to the students.

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Expt. No.	List of equipments	Quantity required for a batch of 30 students
1.	Orifice plate	1
2.	Dead weight tester with pressure gauge	1
3.	Torque trainer	1
4.	Saybolt Viscometer	1
5.	Vacuum gauge	1
6.	DP transmitter	1
7.	UV – Visible spectrophotometer	1
8.	IR spectrophotometer	1
9.	pH meter	1
10.	Conductivity meter	1
11.	ECG trainer	1
12.	Pulse rate trainer	1

EI6612   **PROCESS CONTROL LABORATORY**   **L T P C**
                                                                          0 0 3 2

OBJECTIVES:
To experimentally verify the process control concepts on the selected process control loops.

LIST OF EXPERIMENTS:

1. Study of Process Control Training Plant and Compact Flow Control Unit.
2. Characteristics of Pneumatically Actuated Control Valve (with and without Positioner).
3. Level Control and Pressure Control in Process Control Training Plant.
4. Design of ON/OFF Controller for the Temperature Process.
5. PID Implementation Issues.
6. Tuning of PID Controller for mathematically described processes
7. PID Enhancements (Cascade and Feed-forward Control Schemes)
8. Design and Implementation of Multi-loop PI Controller on the Three-tank system.
9. Analysis of Multi-input Multi-output system (Four-tank System).
10 Study of AC and DC drives.

11 Study of pH Control Test Rig.
12 Auto-tuning of PID Controller

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to understand and analyse process control engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Study of Process control training plant and compact flow control unit.

AIM
To obtain the closed loop response of flow control loop for servo and regulator Operation.

EXERCISE
1. Closed – loop connection is made in the flow process station.
2. The flow controller (P+I) is tuned using any one of the tuning techniques.
3. The response of the control loop is obtained for changes in the set point.
4. The response of the control loop is obtained for changes in the load variable.
5. The step 3 and 4 are repeated for different controller modes and settings.

EQUIPMENT
1. Flow process station with all accessories - 1 No
2. Analog / Digital PID controller - 1 No
3. Recorder - 1 No

2. Characteristics of pneumatically actuated control valve (with and without positioner)

AIM
To determine the flow – lift characteristics (Internet / Installed) of a control valve equipped with and without valve positioner.

EXERCISE
1. Plot the flow – lift characteristics of the given valve without positioner keeping
   (i) Constant ΔP
   (ii) Variable ΔP
2. Compute the valve gain at different operating points.
3. Plot the flow – lift characteristics of the given with positioner keeping.
   i. Constant ΔP
   ii. Variable ΔP
4. Compute the valve gain at different operating points.

EQUIPMENT
1. Control valve trainer (with position for varying ΔP across the valve) - 1 No
2. Flow meter - 1No

3. Level control and pressure control in process control training plant

AIM
To obtain the closed loop response of level control loop for servo and regulator operation.

EXERCISE
1. Closed loop connection is made in the level process station.
2. The level controller (P+I) is tuned using any one of the tuning techniques.
3. The response of the control loop is obtained for changes in the set point.
4. The response of the control loop is obtained for changes in the load variable.
5. The step 3 and step 4 are repeated for different controller modes and settings.

EQUIPMENT
1. Level process station with all accessories - 1 No
2. Analog / Digital PID controller - 1 No
4. Recorder - 1 No

4. Design of ON/OFF controller for the temperature process

AIM
To obtain the ON/OFF response of temperature unit

EXERCISE
1. Open loop characteristic of temperature process.
2. Closed loop ON/OFF control of temperature process.

EQUIPMENT
1. Temperature process station with all accessories

5. PID implementation issues.

Equipment:
Personal computer
MATLAB software

6. Tuning of PID controller for mathematically described processes.

AIM
To study of various controller tuning

Equipment:
Personal computer
MATLAB software

7. PID enhancements (Cascade and Feed-forward control schemes)

AIM
To determine the closed loop performance of a cascade control system and compare it with that of conventional control system.

EXERCISE
1. The secondary and primary controllers are tuned using any one of the tuning techniques.
2. Obtain the closed loop response of cascade control system with the load variable entering the inner loop.
3. Obtain the closed loop regulating response with conventional control system.

4. Compare the performance of conventional control system and cascade control system internal of peak overshoot, setting time, I&E etc

EQUIPMENT:
1. Cascade control system with flow as inner variable and liquid level as outer variable with following accessories.
2. Level transmitter - 1 No
3. Flow transmitter - 1 No
4. Control valve - 1 No
5. Analog / Digital PID controller - 1 No
6. Recorder - 1 No
7. Matlab package

8. Design and implementation of Multi-loop PI controller on the Three-tank system.

AIM
To determine the closed loop performance of a multi-loop system

EXERCISE
1. Design of decentralized controller tuning
2. Design of centralized controller tuning

EQUIPMENT
1. Three tank system with following accessories.
2. Level transmitter - 3 No
3. Pump control unit - 2 No
4. Rota meter - 2 No
5. Personal computer with ADC/DAC card - 1 No
6. Matlab package

9. Analysis of Multi-input Multi-output system (Four-Tank system)

AIM
To determine the closed loop performance of a multi-loop system and
EXERCISE
1. Design of decentralized controller tuning
2. Design of centralized controller tuning

EQUIPMENT
1. Four tank system with following accessories.
2. Level transmitter - 4 No
3. Pump control unit - 2 No
4. Rota meter - 2 No
5. Personal computer with ADC/DAC card - 1 No
6. Matlab package

10. Study of AC and DC drives.

AIM
To determine the closed loop performance of AC and DC drives.

EXERCISE

1. Closed loop control of AC and DC motor.

EQUIPMENT

1. DC and DC motor.
2. Motor control unit for AC motor
3. Motor control unit for DC motor
4. Matlab package

11. Study of pH control test rig.

AIM

To determine the closed loop performance of a nonlinear system

EXERCISE

1. Open loop Characteristics study
2. Closed loop response

EQUIPMENT

1. pH control with following accessories.
2. pH transmitter - 1 No
3. Pump control unit - 2 No
4. Rota meter - 2 No
5. Personal computer with ADC/DAC card - 1 No
6. Matlab package

12. Autotuning of PID controller.

AIM

To study of various controller tuning

EQUIPMENT:

Personal computer
MATLAB software

EI6701	INDUSTRIAL DATA NETWORKS	L T P C
		3 0 0 3

OBJECTIVES:
- To educate on the basic concepts of data networks
- To introduce the basics of inter networking and serial communications
- To provide details on HART and Field buses
- To educate on MODBUS, PROFIBUS and other communication protocol
- To introduce industrial Ethernet and wireless communication

UNIT I   DATA NETWORK FUNDAMENTALS   9
Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing - CSMA/CD, TCP/IP

UNIT II   INTERNET WORKING and RS 232, RS 485   9

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Devicenet

UNIT III   HART AND FIELDBUS   9

Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications - Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).

UNIT IV   MODBUS AND PROFIBUS PA/DP/FMS AND FF   9

MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway

UNIT V   INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION   9

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.

TOTAL :45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004
2. William Buchanan, Computer Buses, CRC Press, 2000.
3. A. Behrouz Forouzan ,Data Communications & Networking ,3RD edition, Tata Mc Graw hill,2006.

REFERENCES:
1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011.
2. Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2nd Edition, 2001.
3. William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.

EI6702   **LOGIC AND DISTRIBUTED CONTROL SYSTEM**   **L T P C**
                                                 3 0 0 3

OBJECTIVES:
- To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
- To give adequate knowledge about applications of PLC
- To give basic knowledge about Computer Controlled Systems

- To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
- To give adequate information with respect to interfaces used in DCS

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9
Evolution of PLCs – Components of PLC – Architecture of PLC – Discrete and analog I/O modules – Programming languages -Ladder diagram – Function block diagram (FBD) - Programming timers and counters

UNIT II APPLICATIONS OF PLC 9
Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions – Case studies in PLC

UNIT III COMPUTER CONTROLLED SYSTEMS 9
Basic building blocks of computer controlled systems – Data acquisition system – Supervisory control – Direct digital control- SCADA:- Hardware and software, Remote terminal units, Master
Station and Communication architectures.

UNIT IV DISTRIBUTED CONTROL SYSTEM 9
DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities

UNIT V INTERFACES IN DCS 9
Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies in DCS

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:
1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation' Marcel Dekker, Inc., Newyork ,1990.

REFERENCES:
1. T.A. Hughes, Programmable Controllers, Fourth edition, ISA press, 2005
2. Krishna Kant, Computer Based Industrial Control, Second edition, Prentice Hall of India, New Delhi, 2010.
3. John W. Webb and Ronald A. Reis, 'Programmable Logic Controllers, Fifth edition, Prentice Hall of India, New Delhi, 2010.
4. John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers, Pearson, New Delhi, 2004.
5. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
6. E.A.Parr, Programmable Controllers, An Engineer's Guide, Elsevier, 2013.

EC6601   **VLSI DESIGN**   **LT P C**
                                                                                                 3 0 0 3

OBJECTIVES:

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

UNIT I   MOS TRANSISTOR PRINCIPLE   9

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II   COMBINATIONAL LOGIC CIRCUITS   9

Examples of Combinational Logic Design, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III   SEQUENTIAL LOGIC CIRCUITS   9

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV   DESIGNING ARITHMETIC BUILDING BLOCKS   9

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V   IMPLEMENTATION STRATEGIES   9

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

                                                                TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students should

- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

TEXTBOOKS:

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997

REFERENCES:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addision Wesley 1993
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India 2005
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007.

EI6703   **FIBRE OPTICS AND LASER INSTRUMENTS**   **L T P C**
                                                                                       3 0 0 3

OBJECTIVES:
- To expose the basic concepts of optical fibers and their industrial applications.
- To provide adequate knowledge about Industrial application of optical fibres.
- To provide basic concepts of lasers.
- To provide knowledge about Industrial application of lasers
- To provide knowledge about Industrial application of Holography and Medical applications of Lasers.

UNIT I   OPTICAL FIBRES AND THEIR PROPERTIES   9
Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II   INDUSTRIAL APPLICATION OF OPTICAL FIBRES   9
Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III   LASER FUNDAMENTALS   9
Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV   INDUSTRIAL APPLICATION OF LASERS   9
Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V   HOLOGRAM AND MEDICAL APPLICATIONS   9
Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

                                                                    TOTAL : 45 PERIODS
OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. R.P.Khare, Fiber Optics and Optoelectronics, Oxford university press, 2008.
2. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.

REFERENCES:
1. Asu Ram Jha, Fiber Optic Technology Applications to commercial, Industrial, Military and Space Optical systems, PHI learning Private limited, 2009.
2. M. Arumugam, Optical Fibre Communication and Sensors, Anuradha Agencies, 2002.
3. John F. Read, Industrial Applications of Lasers, Academic Press, 1978.

EI6704   **BIOMEDICAL INSTRUMENTATION**   **L T P C**
                                                                                3 0 0 3

OBJECTIVES:
- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I   **FUNDAMENTALS OF BIOMEDICAL ENGINEERING**   **9**
Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II   **NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC**
                            PROCEDURES   **9**
Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO_2, pO_2, finger-tip oxymeter - ESR, GSR measurements.

UNIT III   **ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS**   **9**
Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

UNIT IV   **IMAGING MODALITIES AND ANALYSIS**   **9**
Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

UNIT V   **LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES**   **9**
Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

                                                               TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.

3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

REFERENCES:
1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

EC6612	VLSI DESIGN LABORATORY	L T P C
		0 0 3 2

OBJECTIVES
- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarise fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms.
.
LIST OF EXPERIMENTS

FPGA BASED EXPERIMENTS.
1. HDL based design entry and simulation of simple counters, state machines, adders (min 8 bit) and multipliers (4 bit min).
2. Synthesis, P&R and post P&R simulation of the components simulated in (I) above. Critical paths and static timing analysis results to be identified. Identify and verify possible conditions under which the blocks will fail to work correctly.
3. Hardware fusing and testing of each of the blocks simulated in (I). Use of either chipscope feature (Xilinx) or the signal tap feature (Altera) is a must. Invoke the PLL and demonstrate the use of the PLL module for clock generation in FPGAs.

IC DESIGN EXPERIMENTS: (BASED ON CADENCE / MENTOR GRAPHICS / EQUIVALENT)
4. Design and simulation of a simple 5 transistor differential amplifier. Measure gain, ICMR, and CMRR
5. Layout generation, parasitic extraction and resimulation of the circuit designed in (I)
6. Synthesis and Standard cell based design of an circuits simulated in 1(I) above. Identification of critical paths, power consumption.
7. For expt (c) above, P&R, power and clock routing, and post P&R simulation.
8. Analysis of results of static timing analysis.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to
- Write HDL code for basic as well as advanced digital integrated circuits.
- Import the logic modules into FPGA Boards.
- Synthesize, Place and Route   the digital IPs.
- Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.

LAB EQUIPMENTS FOR A BATCH OF 30 STUDENSTS:
Xilinx or Altera FPGA   10 nos
Xilinx software
Cadence/MAGMA/Tanner or equivalent software package   10 User License
PCs   10 No.s

EI6711   **INSTRUMENTATION SYSTEM DESIGN LABORATORY**   **L T P C**
                                                                                         0 0 3 2

OBJECTIVES:
To obtain adequate knowledge in design of various signal conditioning circuits, instrumentation systems, controller and control valve.

LIST OF EXPERIMENTS:

1.   Design of Instrumentation amplifier.
2.   Design of active filters – LPF, HPF and BPF
3.   Design of regulated power supply and design of V/I and I/V converters.
4.   Design of linearizing circuits and cold–junction compensation circuit for thermocouples.
5.   Design of signal conditioning circuit for strain gauge and RTD.
6.   Design of orifice plate and rotameter.
7.   Design of Control valve (sizing and flow-lift characteristics)
8.   Design of PID controller (using operational amplifier and microprocessor)
9.   Design of a multi-channel data acquisition system
10.   Design of multi range DP transmitter
11.   Piping and Instrumentation Diagram – case study.
12.   Preparation of documentation of instrumentation project and project scheduling for the above case study. (process flow sheet, instrument index sheet and instrument specifications sheet, job scheduling, installation procedures and safety regulations).
13.   Programmable Logic Controller – Case study.
14.   One or two experiments beyond syllabus

A separate laboratory manual incorporating Aim, apparatus required, circuit Diagram, graph, Result for each experiment has to be developed by the Department and given to the students

                                                                                TOTAL : 45 PERIODS
OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Expt.No.	List of equipments	Quantity required for a batch of 30 students
1.	Monolithic Instrumentation amplifier Operational amplifiers	2 Nos 4 Nos.
2.	Operational amplifiers	3 Nos.
3.	IC 7805 and resistors, diodes, capacitors Operational amplifier & Loop analyzer	1 No. 5 No. 1 No.
4.	Thermocouple & RTD Opamp	1 No. each 3 No.
5.	Bonded strain gauge, Loads, Opamp	1 No. each
6.	Pump and reservoir Pipeline with orifice plate Collecting tank	1 No. each
7.	Linear control valve, ON/OFF control valve, Air regulator, Rotameter, Pump	1 No. each
8.	IC 741, CRO, Bread board, Signal generator (PID) Microprocessor kit with ADC and DAC section	1 No. each 1 No. each
9.	Any Process station (Temperature or Level) with Corresponding sensors, Data acquisition card, and Storage device (microcontroller/microprocessor)	1 No. More than 2 Nos. 1 No. 1 No.
10.	Flow process station with DP transmitter	1 No

EI6712   **COMPREHENSION**   **L T P C**
                                                                            0 0 2 1

OBJECTIVES:
To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES:
• Ability to review, prepare and present technological developments

MG6851   **PRINCIPLES OF MANAGEMENT**   **LT P C**
                                                                              3 0 0 3

OBJECTIVES:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

UNIT I   INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS   9
Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT II   PLANNING   9
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III   ORGANISING   9
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV   DIRECTING   9
Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT V   CONTROLLING   9
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

                                                                TOTAL: 45 PERIODS
OUTCOMES:
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:
1. Stephen P. Robbins & Mary Coulter, " Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", Pearson Education, 6th Edition, 2004.

REFERENCES:
1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

EI6801   **COMPUTER CONTROL OF PROCESSES**   **L T P C**
                                                                                   3 0 0 3

OBJECTIVES:

* To introduce analysis of discrete time systems in state variable form
* To introduce system identification techniques
* To educate om direct discrete design techniques
* To introduce multi-loop regulatory control
* To introduce multivariable regulatory control

UNIT I   DISCRETE STATE-VARIABLE TECHNIQUE   9
State equation of discrete data system with sample and hold – State transition equation – Methods of computing the state transition matrix – Decomposition of discrete data transfer functions – State diagrams of discrete data systems – System with zero-order hold – Controllability and observability of linear time invariant discrete data system–Stability tests of discrete-data system – State Observer - State Feedback Control.

UNIT II   SYSTEM IDENTIFICATION   9
Non Parametric methods:-Transient analysis–Frequency analysis–correlation analysis– Spectral analysis – Parametric methods:- Least square method – Recursive least square method.

UNIT III   DIGITAL CONTROLLER DESIGN   9
Review of z-transform – Modified of z-transform – Pulse transfer function – Digital PID controller – Dead-beat control and Dahlin's control – Smith predictor – Digital Feed-forward controller – IMC-State Feedback Controller - LQG Control

UNIT IV   MULTI-LOOP REGULATORY CONTROL   9
Multi-loop Control - Introduction – Process Interaction – Pairing of Inputs and Outputs -The Relative Gain Array (RGA) – Properties and Application of RGA – Multi – loop PID Controller– Biggest Log Modulus Tuning Method – De coupler

UNIT V   MULTIVARIABLE REGULATORY CONTROL   9
Introduction to Multivariable control –Multivariable PID Controller -Multivariable IMC– Multivariable Dynamic Matrix Controller – Multivariable Model Predictive Control – Generalized Predictive Controller – Implementation Issues

                                                                       TOTAL: 45 PERIODS
OUTCOMES:

* To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:
1. Soderstorm,T. and Stoica, P., "System Identification", Prentice Hall International Ltd., UK., 1989.
2. Gopal, M., "Digital Control and State Variable Methods", Tata Mc Graw Hill, 2003.
3. Bequette,B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.

REFERENCES:
1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and Practice", Prentice Hall of India, 2005.
2. Seborg, D.E., Edgar,T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2^{nd}Edition, 2003.
3. E.Ikonen and K.Najim, "Advanced Process Identification and Control", Marcel Dekker, Inc. Newyork, 2002.
4. P.Albertos and S.Antonio, "Multi variable Control Systems An Engineering Approach", Springer Verlag, 2004.
5. Sigurd Skogestad,Ian Postlethwaite, "Multi variable Feedback Control: Analysis and Design", John Wiley and Sons, 2004.

EI6811	PROJECT WORK	L T P C
		0 0 12 6

OBJECTIVES:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:
- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

CS6659	ARTIFICIAL INTELLIGENCE	L T P C
		3 0 0 3

OBJECTIVES:
The student should be made to:
- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning.

UNIT I INTRODUCTION TO AI AND PRODUCTION SYSTEMS 9

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

UNIT II REPRESENTATION OF KNOWLEDGE 9

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

UNIT III KNOWLEDGE INFERENCE 9

Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

UNIT IV PLANNING AND MACHINE LEARNING 9

Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

UNIT V EXPERT SYSTEMS 9

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Identify problems that are amenable to solution by AI methods.
- Identify appropriate AI methods to solve a given problem.
- Formalise a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

TEXT BOOKS:
1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008. (Units-I,II,VI & V)
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. (Unit-III).

REFERENCES:
1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
3. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.
4. http://nptel.ac.in

CS6303   **COMPUTER ARCHITECTURE**   **L T P C**
                                                                          3 0 0 3

OBJECTIVES:
- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I   OVERVIEW & INSTRUCTIONS   9
Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

UNIT II   ARITHMETIC OPERATIONS   7
ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III   PROCESSOR AND CONTROL UNIT   11
Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV   PARALLELISM   9
Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

UNIT V   MEMORY AND I/O SYSTEMS   9
Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

                                                              TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design arithmetic and logic unit.
- Design and anlayse pipelined control units
- Evaluate performance of memory systems.
- Understand parallel processing architectures.

TEXT BOOK:
1. David A. Patterson and John L. Hennessey, "Computer organization and design', Morgan Kauffman / Elsevier, Fifth edition, 2014.

REFERENCES:
1. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.

2. William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.
3. Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.
4. Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
5. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.
6. http://nptel.ac.in/.

CS6401   **OPERATING SYSTEMS**   **L T P C**
                                                                                      3 0 0 3
OBJECTIVES:
The student should be made to:
- Study the basic concepts and functions of operating systems
- Understand the structure and functions of OS
- Learn about Processes, Threads and Scheduling algorithms
- Understand the principles of concurrency and Deadlocks
- Learn various memory management schemes
- Study I/O management and File systems
- Learn the basics of Linux system and perform administrative tasks on Linux Servers

UNIT I   OPERATING SYSTEMS OVERVIEW   9
Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II   PROCESS MANAGEMENT   9
Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

UNIT III   STORAGE MANAGEMENT   9
Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV   I/O SYSTEMS   9
Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management; I/O Systems.

UNIT V   CASE STUDY   **9**
Linux System- Basic Concepts;System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design various Scheduling algorithms
- Apply the principles of concurrency
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes
- Design and Implement a prototype file systems
- Perform administrative tasks on Linux Servers

TEXT BOOK:
1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:
1. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
5.   http://nptel.ac.in/

EI6001   **DATA STRUCTURES AND ALGORITHMS**   **L T P C**
                                                                                    3 0 0 3
OBJECTIVES:
- To provide a good understanding of the fundamental data structures used in computer science
- To provide a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To educate on the space and time efficiency of most algorithms
- To educate on design of new algorithms or modify existing ones for new applications
- To introduce graph algorithms

UNIT I   INTRODUCTION AND BASIC DATA STRUCTURES   **9**
Problem solving techniques and examples-Abstract Data Type (ADT)-The list ADT Arrays- Stacks and Queues: Implementation and Application, Circular Queues.

UNIT II   ADVANCED DATA STRUCTURES   **9**
Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees.

UNIT III   SORTING AND HASHING   9

Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment- Heap Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort-Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash functions-Separate Chaining-Open Addressing-Rehashing-Extendible Hashing.

UNIT IV   ALGORITHM DESIGN TECHNIQUES   9

The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer-dynamic programming-Greedy Algorithm – Backtracking.

UNIT V   GRAPHS ALGORITHMS   9

Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-All pairs shortest paths.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:

1. M A Weiss," Data Structures and Algorithm Analysis in C++",3rd Edition, Pearson Education,2007.
2. D.Samantha, "Classic Data Structures", 2nd Edition, PHI Learning, 2012.
3. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest," Introduction to Algorithms", 2nd Edition, prentice Hall of India, 2002

REFERENCES:

1. R G Dromey,"How to solve it by computers", Pearson Education Asia, 2005.
2. Robert L Kruse, Clovis L Tando and Bruce P Leung,"Data structures and Program Design in C",2nd Edition, Prentice Hall of India,1990.
3. D.S. Kushwaha & A.K. Misra, "Data Structures -4 Programming approach with C", PHI Learning, 2012.
4. Varsha H. Patil, "Data Structures Using C++" Oxford University Press, 2012.
5. Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007.

EI6002	**POWER PLANT INSTRUMENTATION**	**L T P C**	
		3 0 0 3	

OBJECTIVES:
- To provide an overview on power generation through various methods
- To educate on the important power plant measurements and devices
- To educate on basic Boiler control techniques
- To educate on advanced Boiler control techniques
- To educate on the turbine control techniques

UNIT I   OVERVIEW OF POWER GENERATION   9

Survey of methods of power generation :– hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plant – Building blocks – Combined Cycle System – Combined Heat and Power System – sub critical and supercritical boilers.

UNIT II   MEASUREMENTS IN POWER PLANTS   9

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

UNIT III   BOILER CONTROL – I   9

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control – Single, two and three element control – Furnace draft control – implosion – flue gas dew point control – Trimming of combustion air – Soot blowing.

UNIT IV   BOILER CONTROL – II   9

Burners for liquid and solid fuels – Burner management – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control – fluidized bed boiler – Cyclone furnace.

UNIT V   CONTROL OF TURBINE   9

Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system – Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries

TEXT BOOKS:

1. Sam Dukelow, Control of Boilers, Instrument Society of America, 1991.
2. Everett Woodruff , Herbert Lammers, Thomas Lammers, Steam Plant Operation,9th Edition McGraw Hill, 2012.
3. Rajput R.K., A Text book of Power plant Engineering. 5th Edition, Lakshmi Publications, 2013.

REFERENCES:

1. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company, 2005.
2. Jain R.K., Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
3. P.K.Nag, Powerplant Engineering, Tata McGraw-Hill Education, 3rd edition, 2007.
4. Tamilmani, Power plant instrumentation, Sams Publishers, 2011.
5. Krishnaswamy.K and Ponnibala.M., Power Plant Instrumentation, PHI Learning Pvt.Ltd., New Delhi, 2011.

EI6003   **INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES**   **L T P C**
                                                                                  3 0 0 3

OBJECTIVES:
To provide sound knowledge about
- To introduce the methods of crude oil extraction, processing and refining
- To educate on Unit operations in petroleum refinery and petrochemical industry
- To introduce Production routes of important petrochemicals, and
- To provide knowledge on Control of selected petrochemicals production processes.
- To educate on the safety in instrumentation systems

UNIT I   OIL EXTRACTION AND PROCESSING   9
Techniques used for oil discovery - seismic survey - methods of oil extraction - oil rig system - Primary and Secondary recovery - Enhanced oil recovery - separation of gas and water from oil - control loops in oil gas separator - scrubber - coalescer

UNIT II   PETROLEUM REFINING   9
Petroleum refining process - unit operations in refinery - thermal cracking - catalytic cracking - catalytic reforming - polymerization - isomerization - alkylation - Production of ethylene, acetylene and propylene from petroleum

UNIT III   CHEMICALS FROM PETROLEUM   9
Chemicals from methane, acetylene, ethylene and propylene - production routes of important petrochemicals such as polyethylene, polypropylene, ethylene dioxide, methanol, xylene, benzene, toluene, styrene, VCM and PVC

UNIT IV   CONTROL LOOPS IN PETROCHEMICAL INDUSTRY   9
Control of binary and fractional distillation columns - Control of catalytic and thermal crackers - control of catalytic reformer - control of alkylation process - Control of polyethylene production – Control of VCM and PVC production

UNIT V   SAFETY IN INSTRUMENTATION SYSTEMS   9
Area and material classification as per National Electric Code (NEC) - Classification as per International Electro technical Commission (IEC) - Techniques used to reduce explosion hazards - Pressurization techniques - Type X, Type Y and Type Z - Intrinsic safety - Mechanical and Electrical isolation - Lower and Upper explosion limit

                                                                  TOTAL : 45 PERIODS
OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries

TEXT BOOKS:
1. Balchen J.G and Mumme K.I., Process Control Structures and Applications, Von Nostrand Reinhold Company, New York, 1988.
2. Ram Prasad, Petroleum Refining Technology, Khanna Publishers, New Delhi, 2000.

REFERENCES:
1. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company, 2005.
2. Waddams A.L., Chemicals from Petroleum, Butter and Janner Ltd., 1968.
3. www.scribd.com/doc/2336259/ABB-Oil-Gas-production-Hand-Book.
4. Considine M. and Ross S.D., Handbook of Applied Instrumentation, McGraw Hill,1964.

IT6005   **DIGITAL IMAGE PROCESSING**   **L T P C**
                                                                                    3 0 0 3

OBJECTIVES:
The student should be made to:
 * Learn digital image fundamentals.
 * Be exposed to simple image processing techniques.
 * Be familiar with image compression and segmentation techniques.
 * Learn to represent image in form of features.

UNIT I   DIGITAL IMAGE FUNDAMENTALS   8
Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - color models.

UNIT II   IMAGE ENHANCEMENT   10
Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – **Frequency Domain:** Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT III   IMAGE RESTORATION AND SEGMENTATION   9
Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering **Segmentation:** Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation-Morphological processing- erosion and dilation.

UNIT IV   WAVELETS AND IMAGE COMPRESSION   9
Wavelets – Subband coding - Multiresolution expansions - **Compression:** Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

UNIT V   IMAGE REPRESENTATION AND RECOGNITION   9
Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

                                                                    TOTAL: 45 PERIODS
OUTCOMES:
Upon successful completion of this course, students will be able to:
 * Discuss digital image fundamentals.
 * Apply image enhancement and restoration techniques.
 * Use image compression and segmentation Techniques.
 * Represent features of images.

TEXT BOOK:
 1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

REFERENCES:
 1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
5. http://eeweb.poly.edu/~onur/lectures/lectures.html.
6. http://www.caen.uiowa.edu/~dip/LECTURE/lecture.html

IC6601	ADVANCED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

UNIT I   STATE VARIABLE DESIGN   9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control

UNIT II   PHASE PLANE ANALYSIS   9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III   DESCRIBING FUNCTION ANALYSIS   9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV   OPTIMAL CONTROL   9

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples.

UNIT V   OPTIMAL ESTIMATION   9

 Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems-Kalman Filter-Application examples..

TOTAL : 45 PERIODS

OUTCOMES:
- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS :
1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. G. J. Thaler, " Automatic Control Systems", Jaico Publishing House 1993.
3. M.Gopal, Modern Control System Theory, New Age International Publishers, 2002.

REFERENCES:
1. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
3. K. Ogata, 'Modern Control Engineering', 4th Edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung,, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

EE6003	**OPTIMISATION TECHNIQUES**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I   LINEAR PROGRAMMING   9

Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method

UNIT II   ADVANCES IN LPP   9

Dualit theory- Dual simplex method - Sensitivity analysis–-Transportation problems– Assignment problems-Traveling sales man problem -Data Envelopment Analysis

UNIT III   NON LINEAR PROGRAMMING   9

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

UNIT IV   INTERIOR POINT METHODS   9

Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNIT V   DYNAMIC PROGRAMMING   9

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion–Computational procedure–Conversion offinal value problem in to Initial value problem.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:
1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006.
3. Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCES:
1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd.
   New Delhi, 2005.

EE6007   **MICRO ELECTRO MECHANICAL SYSTEMS**   **L T P C**
                                                                                 3 0 0 3

OBJECTIVES:
- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I   INTRODUCTION   9
Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II   SENSORS AND ACTUATORS-I   9
Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III   SENSORS AND ACTUATORS-II   9
Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV   MICROMACHINING   9
Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

EE6008 **MICROCONTROLLER BASED SYSTEM DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:
- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx–- Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING 9

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to

Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV   INTRODUCTION TO ARM PROCESSOR   9
ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V   ARM ORGANIZATION   9
3-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution- ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL: 45 PERIODS

OUTCOMES:
- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

EE6006   **APPLIED SOFT COMPUTING**   **L T P C**
                                                                              3 0 0 3
OBJECTIVES:
- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuuzy systems
- To provide comprehensive knowledge of fuzzy logic control to   real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I   ARCHITECTURES – ANN   9
Introduction – Biological neuron – Artificial neuron – Neuron model – Supervised and unsupervised learning- Single layer – Multi layer feed forward network – Learning algorithm- Back propagation network .

UNIT II   NEURAL NETWORKS FOR CONTROL   9
Feedback networks – Discrete time Hopfield networks – Transient response of continuous time system – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

UNIT III   FUZZY SYSTEMS   9

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic –   Introduction to neuro fuzzy system- Adaptive fuzzy system.

UNIT IV   APPLICATION OF FUZZY LOGIC SYSTEMS   9

Fuzzy logic control: Home heating system - liquid level control - aircraft landing- inverted pendulum – fuzzy PID control, Fuzzy based motor control.

UNIT V   GENETIC ALGORITHMS   9

Introduction-Gradient Search – Non-gradient search – Genetic Algorithms: binary and real representation schemes, selection methods, crossover and mutation operators for binary and real coding - constraint handling methods – applications to economic dispatch and unit commitment problems.

TOTAL: 45 PERIODS

OUTCOMES:

* Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.
* To understand and apply computing platform and software for engineering problems.

TEXT BOOKS:
1. Laurance Fausett, Englewood Cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
3. S.N.Sivanandam and S.N.Deepa, Principles of Soft computing, Wiley India Edition, 2nd Edition, 2013

REFERENCES:
1. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
2. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.
3. M.Gen and R,Cheng, Genetic algorithms and optimization, Wiley Series in Engineering Design and Automation, 2000.
4. Hagan, Demuth, Beale, " Neural Network Design", Cengage Learning, 2012.
5. N.P.Padhy, " Artificial Intelligence and Intelligent Systems", Oxford, 2013.
6. William S.Levine, "Control System Advanced Methods," The Control Handbook CRC Press 2011.

IC6701   DIGITAL CONTROL SYSTEM   L T P C
3 0 0 3

OBJECTIVES:
* To introduce the components of digital control system
* To provide knowledge on pulse transfer functions and their analysis
* To introduce stability concepts in discrete domain
* To educate on tuning of PID controllers in discrete domain

- To introduce state variable analysis in discrete domain

UNIT I   INTRODUCTION   9
Introduction to digital control – Sampling Process – Sample and Hold Circuit – Zero and First Order hold – Z-Transform – Inverse Z- Transform – Region of convergence – Initial and Final Value Theorem

UNIT II   PULSE TRANSFER FUNCTION AND TIME RESPONSE   9
Block diagram reduction methods – Reduction Rules- Multi-loop – MIMO Systems – Signal Flow Graph- steady state error – error transfer functions- Error Constants-Time-Domain Analysis of Second Order Systems-Time Response

UNIT III   STABILITY   9
Introduction-Jury Stability Test- Schur-Cohn stability Test- Bilinear transformation- Stability by Pole Location – Root locus method- Bode Plot- Nyquist Plot.

UNIT IV   DIGITAL PID CONTROLLER   9
Cascade Compensation- Digital Lag Lead Compensator by Bode method- Design of P,PI and PID Controller- Ziegler's- Nichols Method, Cohen-Coon Method

UNIT V   STATE SPACE ANALYSIS   9
Realisation of Pulse Transfer Function- Diagonalisation- discretisation of Continuous time systems-State Transition Matrix- Solution of Discrete-time state equations- Controllability and Observability

                                                              TOTAL : 45 PERIODS
OUTCOMES:
- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS:
1. V.I.George and C.P.Kurien, Digital Control System, Cengage Learning, 2012.
2. B.C.Kuo, Digital Control System, 2nd Edition, Oxford University Press, 2010.
3. M.Sami Fadali, Antonio Visioli, Digital Control Engineering Analysis and Design, Academic Press, 2013.

REFERENCES:
1. M.Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill, 3rd Edition, 2009.
2. C.M. Houpis, G.B.Lamount, ' Digital Control Systems- Theory, Hardware, Software', International Student Edition, McGraw Hill Book Co., 1985.
3. Kannan M.Moddgalya, Digital Control, Wiley India, 2007.
4. C.L.Philips and J.M.Pan, "Feedback Control System, Pearson, 2013.

GE6081   **FUNDAMENTALS OF NANOSCIENCE**   **L T P C**
                                                                                3 0 0 3

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I   INTRODUCTION   8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical,   Electronic, Optical,   Magnetic   and   Thermal   properties. Introduction to properties and motivation for study (qualitative only).

UNIT II   GENERAL METHODS OF PREPARATION   9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III   NANOMATERIALS   12
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites,   Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV   CHARACTERIZATION TECHNIQUES   9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V   APPLICATIONS   7
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS),   Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery
                                                                    TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS:
1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Characterization of Surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES
1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

IC6002   **SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**   **LT P C**
                                                                                  3 0 0 3

OBJECTIVES:
- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods
- To impart knowledge on Recursive identification methods
- To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

UNIT I   NON PARAMETRIC METHODS   9
Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II   PARAMETER ESTIMATION METHODS   9
Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III   RECURSIVE IDENTIFICATION METHODS   9
The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification.

UNIT IV   ADAPTIVE CONTROL SCHEMES   9
Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V   ISSUES INADAPTIVE CONTROL AND APPLICATIONS   9
Stability – Convergence – Robustness –Applications of adaptive control.
                                                                TOTAL: 45 PERIODS
OUTCOMES:
- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS:

1. Soder storm T and Peter Stoica, System Identification, Prentice Hall International,1989.
2. Astrom,K.J. and Wittenmark,B., "Adaptive Control", Pearson Education, 2nd Edition, 2001.
3. Sastry,S. and Bodson, M.," Adaptive Control– Stability, Convergence and Robustness", Prentice Hall inc., New Jersey, 1989.

REFERENCES:
1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs,1987.
2. Bela.G.Liptak., "Process Control and Optimization"., Instrument Engineers' Handbook., volume 2, CRC press and ISA, 2005.
3. William S.Levine, "Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.

GE6083   **DISASTER MANAGEMENT**   **L T P C**
                                                                      3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I   INTRODUCTION TO DISASTERS   9
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II   APPROACHES TO DISASTER RISK REDUCTION (DRR)   9
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III   INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT   9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV   DISASTER RISK MANAGEMENT IN INDIA   9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V   DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD
                WORKS   9**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

                                                        TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society

- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:
1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE6757   **TOTAL QUALITY MANAGEMENT**   **L T P C**
                                                                                   3 0 0 3

OBJECTIVES:
- To facilitate the understanding of Quality Management principles and process.

UNIT I   INTRODUCTION   9
Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II   TQM PRINCIPLES   9
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III   TQM TOOLS AND TECHNIQUES I   9
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV   TQM TOOLS AND TECHNIQUES II   9
Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V   QUALITY SYSTEMS   9
Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

OUTCOMES :
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:
1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2006.

REFERENCES:
1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

GE6075   **PROFESSIONAL ETHICS IN ENGINEERING**   **L T P C**
                                                                        3 0 0 3
OBJECTIVES:
- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I   HUMAN VALUES   10
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 – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II   ENGINEERING ETHICS   9
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 III   ENGINEERING AS SOCIAL EXPERIMENTATION   9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV   SAFETY, RESPONSIBILITIES AND RIGHTS   9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V   GLOBAL ISSUES   8
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –

Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:
1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:
1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiri Publications, Erode, 2011.

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

IC6003   **PRINCIPLES OF ROBOTICS**   **L T P C**
                                                                                        3 0 0 3

OBJECTIVES:
- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I   BASIC CONCEPTS   9
Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II   DIRECT AND INVERSE KINEMATICS   9
Mathematical representation of Robots - Position and orientation - Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods-Closed form solution.

UNIT III   MANIPULATOR DIFFERENTIAL MOTION AND STATICS   9
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV   PATH PLANNING   9
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V   DYNAMICS AND CONTROL   9
Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:
1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:
1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

EC6002   **ADVANCED DIGITAL SIGNAL PROCESSING**   **L T P C**
                                                                              3 0 0 3
OBJECTIVES:
- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

UNIT I   DISCRETE-TIME RANDOM SIGNALS   9

Discrete random process – Ensemble averages, Stationary and ergodic processes, Autocorrelation and Autocovariance properties and matrices, White noise, Power Spectral Density, Spectral Factorization, Innovations Representation and Process, Filtering random processes, ARMA, AR and MA processes.

UNIT II   SPECTRUM ESTIMATION   9

Bias and Consistency, Periodogram, Modified periodogram, Blackman-Tukey method, Welch method, Parametric methods of spectral estimation, Levinson-Durbin recursion.

UNIT III   LINEAR ESTIMATION AND PREDICTION   9

Forward and Backward linear prediction, Filtering - FIR Wiener filter- Filtering and linear prediction, non-causal and causal IIR Wiener filters, Discrete Kalman filter.

UNIT IV   ADAPTIVE FILTERS   9

Principles of adaptive filter – FIR adaptive filter – Newton's Steepest descent algorithm – LMS algorithm – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V   WAVELET TRANSFORM   9

Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Explain the parametric methods for power spectrum estimation.
- Discuss adaptive filtering techniques using LMS algorithm and the applications of adaptive filtering.
- Analyze the wavelet transforms.

TEXT BOOKS:

1. Monson H, Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson, Fourth 2007.
3. Dwight F. Mix, "Random Signal Processing", Prentice Hall, 1995.

REFERENCE:

1. Sophocles J. Orfanidis, "Optimum Signal Processing, An Introduction", McGraw Hill, 1990.

GE6084   **HUMAN RIGHTS**   **L T P C**
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OBJECTIVES :
- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I   **9**
Human Rights – Meaning, origin and Development.   Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II   **9**
Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III   **9**
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV   **9**
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V   **9**
Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

                                                                        TOTAL : 45 PERIODS
OUTCOME :
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:
1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.