ANNA UNIVERSITY CHENNAI
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULLA AND SYLLABI FOR
I TO VIII SEMESTER

B.E . ELECTRONICS AND INSTRUMENTATION ENGINEERING (FULL TIME)

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

Programme Educational Objectives

Bachelor of Electronics and Instrumentation Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

1. have successful technical and professional careers in their chosen fields such as Process Control, Electronics & Information Technology.
2. engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics & Instrumentation

Programme Outcomes

The graduates will have the ability to

a. Apply the Mathematical knowledge and the basics of Science and Engineering to solve the problems pertaining to Electronics and Instrumentation Engineering.
b. Identify and formulate Instrumentation Engineering problems from research literature and be able to analyze the problem using first principles of Mathematics and Engineering Sciences.
c. Come out with solutions for the complex problems and to design system components or process that fulfill the particular needs taking into account public health and safety and the social, cultural and environmental issues.
d. Draw well-founded conclusions applying the knowledge acquired from research and research methods including design of experiments, analysis and interpretation of data and synthesis of information and to arrive at significant conclusion.
e. Form, select and apply relevant techniques, resources and Engineering and IT tools for Engineering activities like electronic prototyping, modeling and control of systems/processes and also being conscious of the limitations.
f. Understand the role and responsibility of the Professional Instrumentation Engineer and to assess societal, health, safety issues based on the reasoning received from the contextual knowledge.
g. Be aware of the impact of professional Engineering solutions in societal and environmental contexts and exhibit the knowledge and the need for sustainable Development.
h. Apply the principles of Professional Ethics to adhere to the norms of the engineering practice and to discharge ethical responsibilities.
i. Function actively and efficiently as an individual or a member/leader of different teams and multidisciplinary projects.
j. Communicate efficiently the engineering facts with a wide range of engineering community and others, to understand and prepare reports and design documents; to make effective presentations and to frame and follow instructions.
k. Demonstrate the acquisition of the body of engineering knowledge and insight and Management Principles and to apply them as member / leader in teams and multidisciplinary environments.
l. Recognize the need for self and life-long learning, keeping pace with technological challenges in the broadest sense.

PEO \ PO	a	b	c	d	e	f	g	h	i	j	k	l
1	√	√	√	√	√			√	√	√	√	
2	√	√	√	√	√	√	√				√	√

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY :: CHENNAI 600 025

REGULATION – 2012

B.E . ELECTRONICS AND INSTRUMENTATION ENGINEERING I TO VIII SEMESTERS CURRICULUM AND SYLLABUS

I SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	HS8151	Technical English I	3	1	0	4
2	MA8151	Mathematics - I	3	1	0	4
3	PH8151	Engineering Physics	3	0	0	3
4	CY8151	Engineering Chemistry	3	0	0	3
5	GE8151	Computing Techniques	3	0	0	3
6	GE8152	Engineering Graphics	2	0	3	4
PRACTICAL						
7	PH8161	Physics Laboratory	0	0	2	1
8	CY8161	Chemistry Laboratory	0	0	2	1
9	GE8161	Computer Practices Laboratory	0	0	3	2
10	GE8162	Engineering Practices Laboratory	0	0	3	2
		TOTAL	**17**	**2**	**13**	**27**

II SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	HS8251	Technical English II	3	1	0	4
2	MA8251	Mathematics - II	3	1	0	4
3	PH8252	Physics for Electronics Engineering	3	0	0	3

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4	CY8252	Chemistry for Electrical and Electronics Engineering	3	0	0	3
5	EI8201	Electric Circuits	3	0	0	3
6	EI8202	Electronic Devices, Circuits and Application	3	0	0	3
PRACTICAL						
7	EI8211	Computer Practice II	0	0	3	2
8	EI8212	Electron Devices and Electric Circuits Lab	0	0	3	2
		TOTAL	**18**	**2**	**6**	**24**

III SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	MA8357	Transform Techniques and Partial Differential Equations	3	1	0	4
2	GE8351	Environmental Science & Engineering	3	0	0	3
3	EI8301	Electrical and Electronic Measurements	3	0	0	3
4	EI8302	Electrical Machines	3	0	0	3
5	EI8303	Operational Amplifiers and Linear Integrated Circuits	3	0	0	3
6	EI8304	Transducer Engineering	3	0	0	3
PRACTICAL						
7	EI8311	Electrical Machines Lab	0	0	3	2
8	EI8312	Transducer and Measurement Lab	0	0	3	2
		TOTAL	**18**	**1**	**6**	**23**

IV SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	MA8353	Numerical Methods	3	1	0	4
2	EI8401	Control Engineering	3	0	0	3
3	EI8402	Digital Logic Theory	3	0	0	3

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4	ME8403	Fundamentals of Thermodynamics & Fluid Mechanics	3	1	0	4
5	EI8404	Industrial Instrumentation I	3	0	0	3
6	EI8405	Microprocessor, Microcontroller and Applications	3	0	0	3
PRACTICAL						
7	EI8411	Linear and Digital Integrated Circuits Lab	0	0	3	2
8	EI8412	Microprocessor, Microcontroller and Applications Lab	0	0	3	2
		TOTAL	**18**	**2**	**6**	**24**

V SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	EI8501	Industrial Instrumentation II	3	0	0	3
2	EI8502	Principles of Communication Engineering	3	0	0	3
3	EI8503	Principles of Digital Signal Processing	3	0	0	3
4	EI8504	Process Control	3	0	0	3
5		Elective I	3	0	0	3
6		Elective II	3	0	0	3
PRACTICAL						
7	EI8511	Industrial Instrumentation Lab	0	0	3	2
8	EI8512	Process Control Lab	0	0	3	2
		TOTAL	**18**	**0**	**6**	**22**

VI SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	MG8651	Engineering Management	3	0	0	3
2	EI8601	Analytical Instruments	3	0	0	3
3	EI8602	Computer Control of Processes	3	0	0	3
4	EI8603	Micro controller based system design	3	0	0	3

5		Elective III	3	0	0	3
6		Elective IV	3	0	0	3
PRACTICAL						
7	HS8561	Employability skills	0	0	2	1
8	EI8611	Computer Control of Processes Lab	0	0	3	2
		TOTAL	**18**	**0**	**5**	**21**

VII SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1	EI8701	Logic and Distributed Control System	3	0	0	3
2	EI8702	VLSI Design	3	0	0	3
3	EI8703	Biomedical Instrumentation	3	0	0	3
4		Elective V	3	0	0	3
5		Elective VI	3	0	0	3
6		Elective VII	3	0	0	3
PRACTICAL						
7	EI8711	Creative and Innovative project	0	0	3	2
8	EI8712	System Design Lab	0	0	3	2
		TOTAL	**18**	**0**	**6**	**22**

VIII SEMESTER

S.No	CODE NO	COURSE TITLE	L	T	P	C
THEORY						
1		Elective VIII	3	0	0	3
2		Elective IX	3	0	0	3
PRACTICAL						
3	EI8811	Project work	0	0	12	6
		TOTAL	6	0	12	**12**

TOTAL NO OF CREDITS (INCLUSIVE OF I SEMESTER) : 175

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ELECTIVES FOR ELECTRICAL AND INSTRUMENTATION ENGINEERING

CODE NO.	COURSE TITLE	L	T	P	C
EI8001	Advanced Control Engineering	3	0	0	3
EI8002	Applied Digital Signal Processing	3	0	0	3
EI8003	Applied Soft Computing	3	0	0	3
EI8004	Data Base Management	3	0	0	3
EI8005	Fibre Optics and Laser Instrumentation	3	0	0	3
EI8006	Fundamentals of Data Structures and Algorithms	3	0	0	3
EI8007	Fundamentals of Digital Image Processing	3	0	0	3
EI8008	Fundamentals of Nano Science and MEMS	3	0	0	3
EI8009	Instrumentation in Petrochemical Industries	3	0	0	3
EI8010	Optimization Techniques	3	0	0	3
EI8011	Power Electronics Devices and Circuit	3	0	0	3
EI8012	Real Time Embedded Systems	3	0	0	3
EI8013	Real Time Operating Systems	3	0	0	3
EI8014	Robotics and Automation	3	0	0	3
EI8015	System Identification and Adaptive Control	3	0	0	3
EI8016	Thermal Power Plant Instrumentation	3	0	0	3
EI8017	Unit Operations and Control	3	0	0	3
EI8018	Virtual Instrumentation	3	0	0	3
EI8071	Industrial Data Networks	3	0	0	3
GE8072	Disaster Management	3	0	0	3
GE8073	Human Rights	3	0	0	3

Attested

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HS8151	TECHNICAL ENGLISH I	L T P C
	(For all branches of B.E / B.Tech programmes)	**3 1 0 4**

OBJECTIVES

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

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 & 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) - Lab descriptions (general/ specific description of laboratory experiments) - Definitions - Recommendations; **Grammar -** Use of imperatives - Subject-verb agreement**; Vocabulary -** Compound words - Word Association**; 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 & effect / compare & 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 & 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 & telecast from Radio & 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 & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

TOTAL : 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

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TEXT BOOKS

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

REFERENCE BOOKS

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. **Technical English: Writing, Reading and Speaking.** New York: Longman, 2001.
2. Bailey, Stephen. **Academic Writing: A practical guide for students.** New York: Rutledge, 2011.
3. 3. Morgan, David and Nicholas Regan**. Take-Off: Technical English for Engineering.** Reading: Garnet Publishing Limited, 2008.
4. 4. Thorn, Michael and Alan Badrick. **An Introduction to Technical English.** Harlow**:** Prentice Hall Europe, 1993.
5. 5. Rizvi, M.Ashraf. **Effective Technical Communication.** New Delhi: Tata McGraw-Hill PublishingCompany, 2007.

EXTENSIVE READERS

1. Murthy, Sudha. **Wise & Otherwise**. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway. **Business @ the Speed of Thought: Succeeding in the Digital Economy.** New York: Warner Business Books, 2000.

WEBSITE RESOURCES

- www.uefap.com
- www.eslcafe.com
- www.listen-to-english.com
- www.owl.english.purdue.edu
- www.chompchomp.com

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MA8151	MATHEMATICS – I	L T P C
	(Common to all branches of B.E. / B.Tech. Programmes)	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 – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II INFINITE SERIES **9+3**

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

UNIT II FUNCTIONS OF SEVERAL VARIABLES **9+3**

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV IMPROPER INTEGRALS 9+3

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

UNIT V MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

TOTAL : 60 PERIODS

OUTCOMES:

- This course equips students to have basic knowledge and understanding in one fields of materials and integral

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

REFERENCES:

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8151 ENGINEERING PHYSICS L T P C

(Common to ALL Branches of B.E./B.Tech. Programmes) 3 0 0 3

OBJECTIVE

- To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER 9

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity

- conductions in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radical flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO_2, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperturee - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS 9

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl,

ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

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

TEXTBOOKS:

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications,2003.
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd,2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications,2000.

REFERENCEBOOKS:

1. Sankar, B.N., Pillai.S.O., Engineering Physics, New Age International (P) Ltd.,2007.
2. Rajendran.V Engineering Physics, Tata McGraw-Hill,2009.

CY8151 ENGINEERING CHEMISTRY L T P C

(Common to all branches of Engineering and Technology) 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 acquaint the students with the basics of nano materials, their properties and applications.

UNIT I CHEMICAL THERMODYNAMICS 9

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; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and

isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.

UNIT II POLYMER CHEMISTRY 9

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS 9

Introduction – reaction velocity, factors affecting reaction velocity, rate constant, order of reaction, molecularity, pseudo molecular reactions, zero, first, second and third order reactions, reactions of fractional orders, determination of order of reactions. Catalysis: Auto catalysis - Enzyme Catalysis: Michaelis-Menton equation; factors affecting enzyme catalysis. Heterogeneous Catalysis: Types of adsorption isotherms: Langmuir–Hinselwood and Rideal–Eley Mechanism.

UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Photoprocesses - Internal Conversion, Inter-system crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANOCHEMISTRY 9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS

1. P. Kannan and A. Ravikrishnan, “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India, 2011

REFERENCE BOOKS

1. P.W. Atkins and de Paula Julio, “Physical Chemistry”, Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, “Fundamental of Photochemistry” New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005.
4. V.R.Gowariker, N.V.Viswanathan and Jayadev Sreedhar, “Polymer Science”, New Age International P (Ltd.,), Chennai, 2006

GE8151 COMPUTING TECHNIQUES LT 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. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

REFERENCES

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

GE8152 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 14

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 14

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 trapezoidal 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 14

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 14

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 15

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 and vanishing point 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. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010

REFERENCES

1. K.R.Gopalakrishna., “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. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited ,2008.
5. K. V.Natrajan, “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

PH8161	PHYSICS LABORATORY (common to all branches of B.E./B.Tech. Programmes)	LT P C 0 0 2 1

OBJECTIVES:

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

1.	Torsional pendulum	Determination of rigidity modulus of wire and moment of inertia of disc.
2.	Non – uniform bending	Determination of young's modulus
3.	Lee's disc	Determination of thermal conductivity of a bad conductor
4.	Potentiometer	Determination of thermo e.m.f. of thermocouple
5.	Air wedge	Determination of thickness of a thin sheet of paper
6.	i. Optical fibre	Determination of Numerical Aperture and acceptance angle
	ii. Compact disc	Determination of width of the groove using laser
7.	Acoustic grating	Determination of velocity of ultrasonic waves in liquids
8.	Post office box	Determination of Band gap of a semiconductor
9.	Spectrometer	Determination of wavelength using grating
10.	Viscosity of liquids	Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

TOTAL : 30 PERIODS

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.

CY8161 **CHEMISTRY LABORATORY** **L T P C**

(common to all branches of Engineering and Technology) **0 0 2 1**

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.

1. Estimation of HCI using $Na_2 CO_3$ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

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

REFERENCE BOOKS

1. A text of quantitative inorganic analysis, A. L. Vogel , ELBS London. 1995.
2. Experiments in physical chemistry, D.P. Shoemarker and C.W. Gardad, McGraw Hill, London, 2001.
3. American Public Health Association.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

GE8161 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
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.

GE8162 ENGINEERING PRACTICES LABORATORY L T P C

(Common to all Branches of B.E. / B.Tech. Programmes) 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 & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICE **12**

PLUMBING

Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.

Laying pipe connection to the suction side of a pump – inlet. Laying

pipe connection to the delivery side of a pump – out let.

Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

STUDY

Study of joints in door panels, wooden furniture

Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE **9**

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15

3. MECHANICAL ENGINEERING PRACTICE

WELDING

- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.

- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:

Centrifugal pump, mixies and air conditioners.

- Demonstration on
  (a) Smithy operations like the production of hexagonal bolt.
  (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE 9

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and testing.
- Study of Telephone, FM radio, low-voltage power supplies.

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.

HS8251	TECHNICAL ENGLISH II	L T P C
	(For all branches of B.E / B.Tech programmes)	3 1 0 4

OBJECTIVES

- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I **9+3**

Listening - Listening to informal conversations and participating**; Speaking -** Opening a conversation (greetings, comments on something, 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 & 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 success, thanking one's friend / relatives); **Grammar -** modal verbs, Purpose expressions**; Vocabulary -** Phrasal verbs and their meanings, Using phrasal verbs in sentences**; E-materials -** Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), 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 the time limit - Skimming**; Writing -** Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the 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 & vocabulary - Speed Reading practice exercises; **Language Lab -** Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV **9+3**

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices**; Speaking -** Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the 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 & 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 -** 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 - Pictures for discussion; **Language Lab -** Different models of group discussion

TOTAL : 60 PERIODS

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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.

TEXT BOOKS

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

REFERENCE BOOKS

1. Laws, Anne. **Presentations.** Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig. **Body Language: A Guide for Professionals.** New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. **Telephoning in English.** Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Ur, Penny. **Teaching Listening Comprehension**. Cambridge: Cambridge University Press, 1984.

EXTENSIVE READERS

1. Abdul Kalam, A P J. **Ignited Minds: Unleashing the Power within India.** New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma. **C.V.Raman: A Biography.** New Delhi: Penguin Books India, 2011.

WEB RESOURCES

1. www.esl-lab.com
2. www.englishgrammar.org
3. www.englishclub.com
4. www.mindtools.com
5. www.esl.about.com

MA8251 **MATHEMATICS II** **LT P C**
3 1 0 4

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 DIFFERENTIAL EQUATIONS 9+3

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral -Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 9+3

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions *w z c*, *az*, 1, *z*2 *z* - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for

evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS **9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems –Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms –Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 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. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8252 PHYSICS FOR ELECTRONICS ENGINEERING **L T P C**

(Common to ECE, EEE and E& I Branches) **3 0 0 3**

OBJECTIVE:

- To illustrate, with suitable examples, the concepts of conductors, semiconductors, dielectric, magnetic and superconducting materials.

- To make the students familiarize with the optical properties of materials.
- To introduce the essential principles of physics for electronics and communication engineering applications.

UNIT I ELECTRICAL PROPERTIES OF METALS 9

Classical theory: Drude model - thermal conductivity, thermal resistance - electrical conductivity of nonmetals: semiconductors, ionic crystals and glasses - thin metal films: conductivity and resistivity - Schrödinger wave equation - particle in a box - Tunneling (qualitative) degenerate states - Fermi-Dirac statistics - density of states: electron concentration and Fermi level - band theory of solids: energy band formation (qualitative) - electron effective mass.

UNIT II SEMICONDUCTORS 9

Intrinsic semiconductors: energy band-diagram - direct and indirect band gap semiconductors - carrier concentrations and conductivity - extrinsic semiconductors: compensation doping - temperature dependence of conductivity - degenerate and nondegenerate semiconductors - recombination and minority carrier injection: direct and indirect recombination - minority carrier lifetime - diffusion and conduction equations and random motion - optical absorption - Hall effect and devices - Ohmic contacts - Schottky diode and solar cell.

UNIT III DIELECTRIC MATERIALS AND INSULATION 9

Matter polarization and relative permittivity: definition - dipole moment and polarization vector P-polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization - frequency dependence - local field and Clausius-Mossetti equation - dielectric constant and dielectric loss - Gauss's law and boundary conditions - dielectric strength and insulation break-down in gases, liquids and solids - capacitor materials - typical capacitor constructions - piezoelectricity, ferroelectricity and pyroelectricity - quartz oscillators and filters - piezo and pyroelectric crystals.

UNIT IV MAGNETIC PROPERTIES AND SUPERCONDUCTIVITY 9

Magnetic dipole moment - origin: atomic magnetic moments - magnetic materials: diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism, ferromagnetism - origin and the exchange interaction - saturation magnetization and Curie temperature - ferromagnetic materials: magnetic domains magnetocrystalline anisotropy, domain walls and motion - M versus H behaviour, demagnetization - soft and hard magnetic materials - examples and uses - Giant Magneto Resistance and materials - superconductivity:

properties and classifications - High Tc superconductors - applications.

UNIT V OPTICAL PROPERTIES OF MATERIALS 9

Light waves in a homogeneous medium - refractive index - dispersion: refractive index-wave-length behaviour - group velocity and group index - Fresnel's equations: amplitude, reflection and transmission coefficients, intensity, reflectance and transmittance - complex refractive index and light absorption - Luminescence, phosphors and white LEDs - polarization - optical anisotropy: uniaxial crystals, birefringence, dichroism - electro-optic effect and amplitude modulators.

TOTAL : 45 PERIODS

OUTCOMES:

The student will be able to

- apply the electrical properties of matter while understanding the relevant electrical phenomenon.
- apply the concepts of semi conductors and understand the working principle of all types of semiconductor devices
- apply the concepts of dielectric materials and magnetic properties and understand the electrostatic, electromagnetic, electromechanical behavior of equipments.
- apply the optical properties of materials and understand the electro optic effects.

TEXT BOOKS:

1. Kasap, S.O., Principles of Electronic Materials and Devices, Tata McGraw-Hill, 2007.
2. Palanisamy, P.K., Materials Science, Scitech, 2003
3. Rajendarn V and Marikani A, Materials Science, Tata McGraw Hill, 2006

REFERENCES:

1. Kittel, C., Introduction to Solid State Physics, John Wiley, 1996.
2. James F.Shackelford, Introduction to Materials Science for Engineers, Pearson, 2010.

CY8252 CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERING (Common to Electrical and Electronics engineering, Electronics and Instrumentation) L T P C 3 0 0 3

AIM:

To impart knowledge in the Applied Chemistry topics relevant to electrical and electronics engineering.

OBJECTIVES:

- To know about the electrochemistry and it is applications.

- To understand the basic concepts about the batteries.
- Importance of Conductivity in Solids and specialty polymers.
- Treatment of water for domestic and industrial purpose.
- Familiarize with various type of material analysis.

UNIT I ELECTROCHEMISTRY 9

Electrical conductance- Types of electrode- conductivity of solutions of electrolytes- specific conductance- equivalent conductance- molar conductance- ionic conductance- factors affecting conductance- transport (transference) number- inter ionic attraction theory of conductance. Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential- standard electrode potential(E^o), Nernst equation, Measurement of EMF of the cell - EMF and potential difference- potentiometric measurement. Reference electrodes. Standard hydrogen electrodes- calomel, silver-silver chloride and glass electrodes. Single electrode potential. Measurement and applications- electrochemical series. Determination of pH using glass electrode. Concentration cells- types and applications.

UNIT II 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- components of a reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells. Introduction- batteries- types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 –O_2 fuel cell- applications.

UNIT III CONDUCTIVITY IN SOLIDS AND SPECIALTY POLYMERS 9

Electrical properties of solids- band theory of solids- types of energy bands- application of band theory to solids- semiconductors- types-n and p types- super conductors. Classification of insulating materials based on function and physical state- thermal insulators- optical fibers- organic electronic materials- fullerenes. Introduction to thermoplastics and thermosetting plastics- phenolic and epoxy resins, silicone polymers, rubbers; polyelectrolytes, electrically conducting polymers, polymers with piezoelectric, pyroelectric and ferroelectric properties, photonic polymers, photo resists, basics of LCD and LED.

UNIT IV WATER CHEMISTRY 9

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-external treatment (ion exchange method) - internal treatment-(phosphate, calgon, carbonate, colloidal)-boiler compounds-caustic embrittlement-boiler corrosion-priming and foaming- desalination of brackish water –reverse osmosis.

UNIT V ANALYSIS OF MATERIALS 9

Spectroscopic analyses: principle- instrumentation- block diagram-data analysis and applications of Atomic Absorption Spectroscopy, Flame photometry, Microscopic analyses: Scanning Electron Microscopy, Tunneling Electron Microscopy, Scanning Tunneling Microscopy and Atomic Force Microscopy. Thermal methods: Differential Scanning Colorimetry, Thermo- gravimetric analysis.

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS

1 Jain P.C. & Monica Jain., "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2010.

2 Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009

REFERENCE BOOKS

1 Pahari A., Chauhan B., "Engineering Chemistry"., Firewall Media., New Delhi., 2010.\

2 Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2008.

3 Ashima Srivastava.,Janhavi N N., Concepts of Engineering Chemistry"., ACME Learning Private Limited., New Delhi., 2010.

4 Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry"., Wiley India Pvt Ltd., New Delhi., 2011.

EI8201 ELECTRIC CIRCUITS L T P C

3 0 0 3

OBJECTIVES

The student should be made to:

- analyze simple DC circuits using systemic analysis techniques (basic law).
- apply Thevenin's theorem, Norton's theorem and the superposition theorem to aid circuit analysis.

- AC steady-state circuit concepts (impedance, reactance, etc) and perform AC steady state analysis.
- perform DC and AC steady-state power calculations.
- learn the concepts of three phase circuits.

UNIT I D.C. CIRCUIT ANALYSIS 9

Ohm's law – Ideal voltage and current sources – Independent sources – Dependent sources – Circuit elements – Kirchhoff's Laws – Voltage and Current division in series and parallel circuits, Network reduction – Mesh and Nodal analysis with voltage and current sources – Circuit theorems:- Superposition, Thevenin's, Norton's, Reciprocity and Maximum Power Transfer – Source transformation – Y-Δ transformation .

UNIT II A.C.CIRCUIT FUNDAMENTALS AND ANALYSIS 10

Sinusoidal voltage and current – RMS value – Form factor – Phasor representation of sinusoidal of voltages –Current and Voltage relationship in R, L, and C circuits – Impedance and admittance, power factor concepts in RC, RL and RLC circuits – Impedance combinations – Real power, reactive power, complex power, apparent power – Analysis of simple series and parallel circuits .

UNIT III RESONANCE AND COUPLED CIRCUITS 9

Resonance in parallel and series circuits – Half power frequencies – Bandwidth and Q factor of Resonant circuits – Mutual Inductance – Dot convention – Coefficient of coupling – Sinusoidal steady state analysis of network with coupled inductance .

UNIT IV THREE-PHASE CIRCUIT ANALYSIS 8

Three-phase balanced and unbalanced voltage sources – Three - phase balanced and unbalanced loads – Line voltage and Phase voltage – Phasor diagram and Power in three - phase circuit – Three - phase circuit analysis with star and delta balanced and unbalanced loads – Phasor diagram – Power and power factor measurement in three-phase circuits.

UNIT V TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS 9

Source free RC and RL Circuit responses – Step response of RC and RL circuits – source free RLC series and parallel circuit responses – Step responses of RLC series and parallel circuits – Responses of RC, RL and RLC series circuits to sinusoidal excitation.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and three-phase circuits in sinusoidal steady state.

TEXT BOOKS

1. Edminister, J.A. and Nahvi, M., "Electric Circuits", 4th Edition, Schaum's Outline series, McGraw-Hill, 2002.
2. Husain, A., "Networks and Systems", Khanna Publishers, 2000.

REFERENCE BOOKS

1. Boylsted, R.L., "Essentials of Circuit Analysis", Prentice Hall, 2003.
2. HAYT, Jr.W.H., Kemmerly, J.E., and Durbin, S.M., "Engineering Circuit Analysis", Tata McGraw-Hill, 2002.
3. Alexander, C.K., Matthew, N.O., and Sadiku, "Fundamentals of Electric Circuits", Tata McGraw- Hill, 2003.
4. Decarlo, R.A. and Lin, P.M., "Linear Circuit Analysis", Oxford University Press, 2001.

EI8202 ELECTRONIC DEVICES, CIRCUITS AND APPLICATION L T P C

3 0 0 3

OBJECTIVES:

The student should be made to:

- understand principle of current flow through the p-n junction and relating this phenomena they will be taught to characterise and operate diodes, bipolar and field-effect transistors.
- learn the function and application of the diodes, bipolar junction and field effect transistors in electronic circuits.
- gain knowledge about the operation of multistage and differential amplifiers.
- design and analyse feedback amplifiers and oscillators.

UNIT I PN JUNCTION DEVICES 9

Semiconductor conductivity - drift current and diffusion current - PN junction - barrier voltage - diode equation - diffusion and transition capacitance - Application of diode as rectifier, clipper and clamper. Special devices and applications, Zener diode as voltage regulator, Schottky diodes for high speed switching, UJT relaxation oscillator, Thyristors - SCR , Diac and Triac.

UNIT II BIPOLAR JUNCTION TRANSISTORS AND APPLICATIONS 9

BJT operation – Characteristics and h-parameters for CE, CB, CC configurations - Design of biasing circuits – Small signal model - High frequency model – Gain-Bandwidth product – CE, CB and CC amplifiers – Transistor Switching circuits.

UNIT III JFET, MOSFET AND THEIR APPLICATIONS 9

JFET and MOSFET device structure and current equation - Equivalent circuit – Biasing – CS, CG and CD amplifiers. Frequency response of CS amplifier – NMOS and CMOS inverter.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BJT cascaded amplifiers - Single and double tuned amplifiers – gain and frequency response – BJT and FET Differential amplifiers – common mode and difference mode analysis.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – Feedback amplifiers with voltage / current sampling and series / shunt mixing – Positive feedback – Condition for oscillations – Phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

(Practice Tutorial Problems for all the above topics.)

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- apply basic concepts of common semiconductor devices and electronic circuits for an application. The students will be capable to learn how to analyse simple but important applications of these devices in electronic circuits.

TEXT BOOKS

1. David A. Bell ,Electronic Devices and Circuits, Oxford University Press, 2010.
2. Sedra and Smith, Microelectronic Circuits, Oxford University Press, 2004.

REFERENCES

1. Jacob Millman, Christos c. Halkias and Satyabrata Jit, Millman's Electronic Devices and Circuits, Third edition, Tata McGraw Hill, 2010.

EI8211 **COMPUTER PRACTICE II** **L T P C**
0 0 3 2

OBJECTIVES

The student should be made to:

- To introduce various programs included in office suite to the students so that they can make use of the same for producing documents, present and visualize data using work sheets.
- To make them learn C programming language.

1. Shell Commands, Wild Cards, Escaping and Redirection.
2. Pipes, Tees and Command Substitution.
3. Shell Variables, Simple program using Shell Scripting.
4. Shell Programs using Loops.
5. Simple Shell Programs using File I/O.
6. Advanced Shell Programs using File I/O.
7. Directories and inodes.
8. Simple programs using classes for understanding objects, member function, constructions and destructors.
9. Programs using operator overloading including unary operators, new and delete
10. Programs using inheritance concepts
11. Programs using virtual functions and dynamic polymorphism
12. Programs using templates.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Use any office suite
- Use spreadsheets for presentations of data
- Use spreadsheets to produce visualizations
- Write simple C programs using various constructs
- Improve upon it for developing programs of moderate complexity

EI8212 ELECTRON DEVICES AND ELECTRIC CIRCUITS LABORATORY L T P C
0 0 3 2

OBJECTIVES :

The student should be made to:

- learn and to verify circuit theorems.
- analyse the frequency response of series and parallel resonance circuits.
- study the characteristics of ordinary and special diodes.
- design and understand the operation and characteristics of different transistor configurations.

LIST OF EXPERIMENTS

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers, ADC converters etc.
- make decisions regarding their best utilization in a specific situation.

MA8357	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	LT P C 3 1 0 4

OBJECTIVES

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- 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 in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Classification of Partial Differential Equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous PDE.

UNIT II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity –Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 9+3

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9+3

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9+3

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

TOTAL : 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 BOOK:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 11th Reprint , 2010.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics",Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

GE8351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To study the nature and 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 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – 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 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

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 over-utilization of surface and ground water, floods, drought, conflicts over 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. 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.

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 – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- 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 – 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).

REFERENCE BOOKS

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',Jaic Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVTLTD,New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

EI8301 ELECTRICAL AND ELECTRONIC MEASUREMENTS L T P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- analyze the electric circuits using network theorems.
- learn the fundamentals of AC circuits like RL,RC and RLC circuits.
- Gain knowledge on Resonance theory and magnetic coupling.
- Study about poly phase circuits.

UNIT I MEASUREMENT OF ELECTRICAL PARAMETERS 9

Types of ammeters and voltmeters – PMMC Instruments, Moving Iron Instruments Dynamometer type Instruments, Resistance measurement - Wheatstone bridge,Kelvin double bridge and Direct deflection methods, Measurement of Inductance - Maxwell Wein bridge, Hay's bridge and Anderson bridge, Measurement of Capacitance - Schering bridge

UNIT II POWER AND ENERGY MEASUREMENTS 9

Electrodynamic type wattmeter – theory and its errors; LPF wattmeter, Phantom loading, Single phase Induction type energy meter theory and Adjustments, Calibration of wattmeter and Energy meters.

UNIT III POTENTIOMETERS AND INSTRUMENT TRANSFORMERS 9

Student type potentiometer, Precision potentiometer, A.C. Potentiometers – Polar and Co-

ordinate types – Applications, Instrument Transformer - Construction and theory of Current Transformers and Potential Transformers.

UNIT IV ANALOG AND DIGITAL INSTRUMENTS 10

Wave analyzers, Signal and function generators, Distortion factor meter, Q meter, Digital voltmeter and multimeter, DMM with auto ranging and self diagnostic features, Frequency measurement.

UNIT V DISPLAY AND RECORDING DEVICES 8

Cathode ray oscilloscope - Sampling and storage scopes –Seven segment and dot matrix displays, X-Y recorders, Magnetic tape recorders, Data loggers.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the working principle of all types of common electrical and electronic instruments.
- Gain knowledge on analog and digital instruments.
- understand the different types of display and recording devices.

TEXT BOOKS:

1. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai and Co, New Delhi, 2010
2. R.B. Northrop, Introduction to Instrumentation and Measurements,Taylor & Francis, New Delhi, 2008
3. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011
4. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. Bell, A.D., “Electronic Instrumentation and Measurements”, 2nd Edition, Prentice Hall of India, New Delhi, New Delhi, 2003.
2. Bowens, A. J, “Digital Instrumentation”, 4th Edition, Tata McGraw - Hill India Ltd., 1997.

EI8302 **ELECTRICAL MACHINES** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- study about the construction and working principle of DC machines, AC Machines, transformers, synchronous machines and induction machines.
- learn the procedure for selecting machines for different applications.

UNIT I D.C. MACHINES **9**

Construction of D.C. Machines, Principle of operation of D.C. generator, EMF equation, Characteristics of D.C. generators, Armature reaction, Commutation. Principle of operation of D.C. motor, Types, Torque equation, Characteristics, Starters, Speed control of D.C. motors.

UNIT II TRANSFORMERS **9**

Principle, Theory of ideal transformer, EMF equation, Construction details of shell and core type transformers, Tests on transformers, Equivalent circuit, Phasor diagram, Regulation and efficiency of a transformer. Introduction to three, phase transformer connections.

UNIT III SYNCHRONOUS MACHINES **9**

Alternator - Construction and principle of operations Equation of induced EMF and Vector Diagram-Voltage regulation; Synchronous motor - Starting methods, Torque, V -curves, Speed control and Hunting.

UNIT IV INDUCTION MACHINES **9**

Induction motor, Construction and principle of operation, Classification of induction Motor, Torque equation,Condition for maximum torque, Equivalent Circuit, Power losses, Efficiency, Starting methods and Speed control.

UNIT V SPECIAL MACHINES **9**

Types of single phase motor, Double revolving field theory, Cross field theory, Capacitor start

capacitor run motors, Shaded pole motor, Repulsion type motor, Universal motor, Hysterisis motor, Permanent magnet synchronous motor, Switched reluctance motor, Brushless D.C motor.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- gain knowledge about the construction, working principle and applications of DC machines, AC machines and special machines.

TEXT BOOKS:

1. Nagrath, I.J., and Kothari, D.P., " Electrical Machines", Tata McGraw - Hill, 1997.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw - Hill, Singapore, 2000.

REFERENCE BOOKS:

1. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chandand Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and SonsLtd., London, 1999.

EI8303	OPERATIONAL AMPLIFIERS AND LINEAR INTEGRATED CIRCUITS	L T P C 3 0 0 3

OBJECTIVES:

The student should be made to:

- study the fundamentals of integrated circuit's fabrication and operation.
- learn the functions of linear and non-linear integrated circuits for specific applications.
- understand the operation of special function integrated circuits for Instrumentation and process control applications.
- get knowledge about the different types of A/D and D/A converters.
- gain knowledge on design and analysis of linear and non linear circuits using operational amplifiers.

UNIT I FABRICATION OF IC AND OP-AMP SPECIFICATIONS 9

IC classification - fundamentals of monolithic IC technology - epitaxial growth, masking and etching, diffusion of impurities- Realization of monolithic ICs and packaging- Fabrication of diodes, capacitance, resistance - Operational amplifiers, specifications, frequency compensation - slew rate and methods of improving slew rate.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Linear and Nonlinear Circuits using operational amplifiers and their analysis - Inverting and Non inverting Amplifiers - Differentiator - Integrator - Voltage to Current converter - Instrumentation amplifier - Sine wave Oscillators - Low pass and band pass filters - Comparator - Multivibrator and Schmitt trigger - Triangular wave generator - Precision rectifier - Log and Antilog amplifiers - Non-linear function generator. Practice tutorial problems.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analysis of four quadrant and variable transconductance multipliers - Voltage controlled Oscillator - Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Analog switches - High speed sample and hold circuits and sample and hold IC's - Types of D/A converter - Current driven DAC - Switches for DAC - A/D converter, Flash, Single slope, Dual slope, Successive approximation - DM and ADM converters.

UNIT V SPECIAL FUNCTION IC'S 9

Timers - Voltage regulators - linear and switched mode types - Switched capacitor filter - Frequency to Voltage converters - Tuned amplifiers - Power amplifiers - Isolation Amplifiers - Opto couplers.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the fundamentals of integrated circuit's fabrication and operation.
- apply the concepts of special function integrated circuits for Instrumentation and process control applications and concepts of different types of A/D and D/A converters.

TEXT BOOK:

1. D.Roy Choudhery,Sheil B.Jain, Linear Integrated Circuits, 2nd Edition, New Age Publishers, 2003.

REFERENCES:

1. Ramakant A. Gayakwad, Op - Amp and Linear IC's, Prentice Hall, 2000.
2. Robert F.Coughlin and Ferderick F. Driscoll, Operational Amplifiers and Linear Integrated Circuits, Prentice Hall of India, 2001.
3. David A Bell, Op-amp and Linear ICs, Second Edition, Prentice Hall of India, 1997.

EI8304 TRANSDUCER ENGINEERING L T P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- study about the concepts of measurement, error and uncertainty.
- gain knowledge on the static and dynamic characteristics of measuring instruments.
- Learn about the principle, operation and characteristics of different variable resistance transducers.
- understand the principle of operation and characteristics of different variable inductance transducers
- develop knowledge on operation and applications of piezo electric and Hall effect 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, SQUID sensors, Film sensors, MEMS – Nano sensors.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the concepts of measurement, error and uncertainty .
- know the principle of operation and characteristics of different types of 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.

REFERENCE BOOKS:

1. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2010. E.A.
2. John P.Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2000.
3. Murthy, D.V.S., Transducers and Instrumentation, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
4. W.Bolton, Engineering Science, Elsevier Newnes, Fifth edition, 2006.

EI8311 ELECTRICAL MACHINES LABORATORY L T P C
0 0 3 2

OBJECTIVES :

The student should be made to:

- understand the procedure to obtain the characteristics of DC and AC machines with

and without load.

1. Open circuit and load characteristic of DC Shunt Generator**.**
2. Speed control of DC Shunt Motor.
3. Load test on DC Shunt Motor.
4. Load test on DC Series Motor.
5. Regulation of three - phase Alternator.
6. Predetermination of efficiency and regulation of Single - phase Transformer.
7. Load test on Single - phase Transformer
8. Load test on Three - phase Induction Motor.
9. Load test on Single - phase Induction Motor.
10. 'V' curves of Synchronous Motor.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- know about the characteristics of DC and AC machines with and without load.

EI8312 TRANSDUCERS AND MEASUREMENT LABORATORY L T P C
0 0 3 2

OBJECTIVES :

The student should be made to:

- know the procedure to obtain the static and dynamic characteristics of various types of transducers.
- study the procedure to measure unknown resistance, inductance and capacitance using bridge circuits.
- gain knowledge to calibrate electrical instruments.
- learn about the flapper nozzle system.

1. Characterisation of loading effect on Potentiometer.
2. Dynamic characteristics of various types of Thermocouple with and without thermo wells.

3. Design of cold junction compensation for Thermocouples.
4. Static and Dynamic characteristics of RTD and lead wire compensations.
5. Static characteristic of Thermistor and its linearization.
6. Static characteristic of LVDT and null voltage compensation.
7. Calibration of Strain Gauge type force and torque transducers.
8. Calibration of magnetic and photoelectric type velocity transducers.
9. Static characteristic of flapper-nozzle system.
10. Characteristics of Synchros.
11. Study of Capacitive transducer.
12. Calibration of vibration sensor.
13. Design of signal conditioning circuits and PC interfacing.
14. Wheatstone and Kelvin's bridge for measurement of resistance.
15. Schering Bridge for capacitance measurement and Anderson Bridge for inductance measurement.
16. Calibration of Energymeter.
17. Calibration of Voltmeter and Ammeter using potentiometer

TOTAL : 45 PERIODS

OUTCOMES :

At the end of the course, the student should be able to:

- obtain the static and dynamic characteristics of various types of transducers.
- measure unknown resistance, inductance and capacitance using bridge circuits.
- calibrate electrical instruments.

MA8353 **NUMERICAL METHODS** **L T P C**
3 1 0 4

OBJECTIVES

- To provide the mathematical foundations of numerical techniques for solving linear system, eigenvalue problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+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 methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 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 and second 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: 60 PERIODS

OUTCOMES:

- Able to have a clear perception of the power of numerical techniques, ideas and 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, New Delhi, 9th Edition, 2011.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', Prentice Hall of India Private Ltd., New Delhi, 3rd Edition,2007.

REFERENCES:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.

EI8401 CONTROL ENGINEERING L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge about the different methods of representation of systems,their transfer function models and state space models.
- develop state space models of selective systems.
- learn about the time response of systems subjected to different test inputs and the associated steady state/dynamic errors.
- understand the open loop and closed loop frequency responses of systems, and analyze the stability and performance.
- Know about the concept of stability of control systems and methods of stability analysis using root locus approach and Routh-Hurwitz criterion.
- Know and practically implement the procedure to design lag, lead and lag-lead compensators for a control system.

UNIT I INTRODUCTION 9

Control System-Open and Closed Loop-Effect of Feedback-System representations-Transfer functions, Block diagrams, signal flow graphs, gain formula of Mechanical and Electrical Systems.

UNIT II STATE VARIABLE MODEL AND ANALYSIS 9

State variable Formulation – solution - state transition matrix – eigen values – eigenvectors -controllability - observability.

UNIT II TRANSFER FUNCTION MODEL AND ANALYSIS 9

Time response – damping ratio- natural frequency – effects of adding poles and zeros – dominant poles- Stability – Routh's Hurwitz criterion – Root locus plots of typical systems – Root locus analysis.

UNIT IV FREQUENCY DOMAIN ANALYSIS OF TRANSFER FUNCTION MODELS 9

Frequency response – resonance peak – Bandwith – effect of adding poles and zeros – Magnitude and phase plots of typical systems– Gain margin – Phase margin-Bode plot– Nyquist's stability criterion

UNIT V DESIGN OF CONTROL SYSTEMS 9

Design Specification – controller configurations – PID controller – Lag-Lead, Lag & Lead Compensator-Design using Rootlocus technique.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- apply concepts of Linear control theory and design for a system.

TEXT BOOKS:

1. Benjamin C.Kuo, "Automatic Control Systems", PHI Learning Private Ltd, 2010
2. I.J.Nagrath, M.Gopal, Control Systems Engineering, New Age International Publishers Reprint 2008.

REFERENCES:

1. Richard C.Dorf Robert H.Bishop, "Modern Control Systems", Education Pearson, Third Impression 2009.
2. John J.D'Azzo Constantine H.Houpis Stuart N.Sheldon, "Linear Control System Analysis and Design with MATLAB" CRC Taylor & Francis Reprint 2009.
3. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, 5th Edition, 2010

EI8402 **DIGITAL LOGIC THEORY** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge on implementation of logic circuits using gates.
- understand the basic concepts of Boolean algebra and combinational circuits.
- learn about the operation of flip flops and will be able to design a synchronous and asynchronous sequential circuits.
- study the basic concepts of state machine diagrams and its applications.
- Get exposure on programmable logic devices and VHDL programming.

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS **9**

Boolean algebra - De-Morgan's theorem - switching functions and simplification using K-maps method- Design of combinational circuits - adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Logic families - TTL and ECL. MOSFET logic –NMOS and CMOS.

UNIT II SYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Flip flops - SR, D, JK , and T flip flops - Semiconductor Memories - Analysis and design of synchronous sequential circuits – Counters, Shift registers - state diagram - state reduction - state assignment **.**

UNIT III ASYNCHRONOUS SEQUENCTIAL CIRCUITS **9**

Analysis of asynchronous sequential circuits - state assignment - asynchronous design problems.

UNIT IV ALGORITHMIC STATE MACHINE **9**

ASM Chart - Data path Subsystem - Control subsystem - Design examples- Binary multiplier, Weighing machine and Waveform generator.

UNIT V PROGRAMMABLE LOGIC DEVICES AND VHDL **9**

ROM, PROM, EPROM, PLA, PLD, FPGA, VHDL : RTL Design – combinational logic – Types

– Operators – Packages – Sequential circuit – Sub programs – Test benches (Examples: adders, counters, flipflops, FSM, Multiplexers / Demultiplexers).

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- gain knowledge on the fundamental concepts and design of digital systems.
- Learn the function of flip flops and able to design a synchronous and asynchronous sequential circuits.
- understand programmable logic devices and VHDL programming.

TEXT BOOKS:

1. M. Morris Mano, Digital Design, Pearson Education, 2006.
2. A. Anand Kumar, Switching Theory and Logic Design, Prentice Hall of India, 2008.

REFERENCES:

1. Charles H.Roth, Fundamentals Logic Design, Jaico Publishing, IV edition, 2002.
2. G.K.Kharate, Digital Electronics, Oxford University Press, 2010.
3. John M.Yarbrough, Digital Logic, Application & Design, Thomson, 2002.
4. Floyd and Jain, Digital Fundamentals, 8th Edition, Pearson Education, 2003.
5. John F.Wakerly, Digital Design Principles and Practice, 3rd Edition, Pearson Education, 2002.

ME8403	FUNDAMENTALS OF THERMODYNAMICS AND FLUID MECHANICS	L T PC 3 1 0 4

OBJECTIVES :

The student should be made to:

- study the basic laws of thermodynamics, laws and methodologies for the analysis of gas turbines and compressors.
- Learn about the basic steaming process of boilers, Air conditioning and different modes of heat transfer.
- gain knowledge on the basic concepts of fluid mechanics.
- understand of the construction and working principle of pumps and hydraulic turbines.

UNIT I LAWS OF THERMODYNAMICS AND BASIC IC ENGINE CYCLES 15

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 12

Properties of steam – Ranking cycle—Boilers and its accessories– Basic thermodynamics of refrigerators and heat pumps.-Basics of Heat transfer

UNIT III BASIC CONCEPT OF FLUID MECHANICS &FLOW OF FLUIDS 12

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 – head of 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 12

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 : 60 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the basic laws of thermodynamics, laws and apply it to various applications.
- know basic concepts of fluid mechanics.
- Know the construction and working principle of pumps and hydraulic turbines.

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

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
6. Radhakrishnan, E., 'Introduction to fluid Mechanics', Prentice Hall, India 2005.
7. Rajput R.K., 'Fluid Mechanics and Hydraulic Machines', S.Chand and Co., India 1998.

EI8404 INDUSTRIAL INSTRUMENTATION I L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- understand the construction and working of instruments used for measurement of force, torque, velocity, acceleration, vibration and density.
- study about the different types of pressure measurement techniques.
- learn the concept of calibration of instruments used for temperature and pressure measurement.
- gain knowledge on the design signal conditioning circuits and compensation schemes for temperature measuring instruments.
- learn how to select the instruments according to a specific application.

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 tacho generators, 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:

At the end of the course, the student should be able to:

- understand the construction and working of instruments used for measurement of force, torque, velocity, acceleration, vibration and density, temperature and pressure.
- select instruments according to the application.

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.

REFERENCE BOOKS

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.

EI8405	MICROPROCESSOR, MICROCONTROLLER AND APPLICATIONS	L T P C 3 0 0 3

OBJECTIVES :

The student should be made to:

- know architecture of 8085,8086 Microprocessors and 8051 microcontroller.
- learn assembly language programming in 8085,8086 Microprocessors and 8051 microcontroller.
- understand the concept about peripherals and their interfacing with Microprocessors and microcontrollers.
- Gain knowledge on Microcontroller based systems for industrial applications.

UNIT I 8085 PROCESSOR 9

Evolution of Microprocessors - Introduction to 8085 – Signals - Architecture - Addressing Modes –- Instruction format –Instruction set –Assembly Language Programming -Counters and Time delays - Interrupts - Timing diagrams - Memory and I/O Interfacing.

UNIT II 8086 PROCESSOR 9

Introduction to 8086 - Architecture –Maximum mode - Minimum mode - Addressing Modes - Instruction format - Instruction set – Assembly Language Programming – Interrupt system - Memory and I/O interfacing - Strings - procedures and Macros.

UNIT III PERIPHERAL INTERFACING 9

Programmable Peripheral Interface (8255) - keyboard display controller (8279) – ADC - DAC Interface - Programmable Timer Controller (8254) - Programmable interrupt controller (8259)

- Serial Communication Interface (8251)- DMA Controller(8257).

UNIT IV MICROCONTROLLER **9**

8051 Microcontroller- Architecture - Instruction Set –Addressing modes –Interrupts - Assembly Language Programming - Programming 8051 Timers- Serial Port Programming - Interrupts Programming - 8051 Programming in C.

UNIT V MICRO CONTROLLER BASED SYSTEM DESIGN **9**

LCD & Keyboard Interfacing- Interfacing with 8255 - ADC, DAC interfacing - External Memory interfacing - I2C Standard- Motor Control- Relay – PWM - DC & Stepper Motor - Design of traffic light control and Washing machine control.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- know architecture and development of assembly language programming of 8085,8086 Microprocessors and 8051 micro controller.
- Apply knowledge on Microcontroller based systems for industrial applications.

TEXTBOOKS

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fourth edition, Penram International Publishing 2006.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition, Indian edition 2007. Tata McGraw Hill
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.

REFERENCES

1. Krishna Kant, Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, 2010.
3. A.K. Ray, K.M .Bhurchandi Advanced Microprocessor and Peripherals, Tata McGraw-Hill, 2007.
4. Kenneth J.Ayala., The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2007.

EI8411	LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L T P C 0 0 3 2

OBJECTIVES :

The student should be made to:

- know the procedure to design and implement linear and non-linear circuits using linear ICs.
- gain knowledge on design and verification of combinational and sequential logic circuits.
- understand VHDL programming.

LINEAR IC APPLICATIONS

1. Comparator.
2. Differentiator and Integrator.
3. Adder and Subtractor.
4. Clipper and clamper.
5. Peak detector.
6. Timer IC Application.
7. VCO and PLL.
8. One experiment beyond the syllabus.

DIGITAL EXPERIMENTS

1. Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND gates, JK, RS, D flip-flops
2. Implementation of Boolean functions
3. Combinational logic design: Adder, Subtractor,
4. Code converters, Encoder and Decoder.
5. Sequential logic design: Counters (Synchronous and Asynchronous),
6. Shift registers.
7. Simulation experiments: Design of Adder and counter using VHDL.
8. One experiment beyond the syllabus.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- design and implement linear and non-linear circuits using linear ICs.
- design and verify combinational and sequential logic circuits and get familiarized with VHDL programming.

EI8412	MICROPROCESSOR, MICROCONTROLLER AND APPLICATIONS LABORATORY	L T P C 0 0 3 2

OBJECTIVES :

The student should be made to:

- Learn assembly level programs in 8085 and 8086 Microprocessors and 8051 microcontroller.
- know the procedure for Interfacing of peripheral devices such as PPI, Timer, ADC/ DAC with microprocessor and microcontroller.
- understand 8085/8255/8051 simulation software.
- gain knowledge on implementation of microprocessor based applications such as of Stepper Motor Controller, Traffic Light Controller, PID controller and Data Acquisition System

8085 BASED EXPERIMENTS:

1. Assembly Language programming of 8085. (i. Addition, ii. Subtraction, iii. Multiplication, iv. Division, v. Sorting, vi. Searching)
2. Interfacing experiments (with 8279, 8255, 8251, ADC, DAC, Traffic Light and Stepper motor)

8051 BASED EXPERIMENTS:

1. Programming using Arithmetic, logical and Bit Manipulation instructions of 8051 microcontroller.
2. Programming and Verifying Timer, Interrupts and UART operations in microcontroller.
3. Interfacing ADC and DAC.
4. Interfacing (16X2) LCD Display.
5. Temperature measurement.

6. DC motor speed control.

8086 BASED EXPERIMENTS:

1. Programs for 16 bit Arithmetic, Sorting, Searching and String operations.
2. Macro assembler Programming for 8086. (Simulator)

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- write and debug assembly level programs in 8085 and 8086 Microprocessors and 8051 microcontroller.
- use 8085/8255/8051 simulation software.
- design and implement the microprocessor based applications such as of Stepper Motor Controller, Traffic Light Controller, PID controller and Data Acquisition System

EI8501 INDUSTRIAL INSTRUMENTATION II L T P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- learn the construction, installation and working of different variable head type flow meters.
- Know about the construction, working and calibration of different quantity flow meters, variable area flow meters and mass flow meters.
- gain knowledge about the construction, installation and working of electrical type, open channel and solid flow meters.
- Understand the principle, operation and application of different level measuring instruments.
- learn the principle and operation of viscosity, humidity and moisture measurement.

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 – Elbow taps - 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 method - Bubbler system - Load cell – Electrical types:– Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge – Boiler drum level measurement:– Differential pressure and Hydrastep methods - Solid level measurement.

UNIT V MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE **9**

Viscosity:– Saybolt viscometer - Rotameter type and Torque type viscometers – Consistency meters–Humidity:- Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter – Moisture: - Different methods of moisture measurements – Thermal and Distillation methods- Conductivity and Capacitive sensors-Microwave, IR and NMR sensors-Application of moisture measurement Moisture measurement in solids**.**

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the construction, installation and working of different variable head type flow meters.
- analyze the different level measuring instruments and gain knowledge about the principles of viscosity, humidity and moisture measurement.

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.

REFERENCE BOOKS

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.

EI8502 PRINCIPLES OF COMMUNICATION ENGINEERING L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- learn the basic concept of Amplitude and Angle Modulation.
- Gain knowledge about different pulse modulation and Demodulation techniques.
- Study about the digital modulation techniques and evaluate the error probability.
- gain knowledge on various modes of communication systems.

UNIT I AMPLITUDE MODULATION 9

Basic principle of AM – Frequency spectrum and Bandwidth, Modulation index, AM power distribution and AM modulator circuits. AM transmitters. Low level transmitters and High level transmitters AM reception: AM Receivers, Tuned Radio Frequency receivers, Super-heterodyne receivers and Double conversion AM receivers.

UNIT II ANGLE MODULATION 9

FM and PM waveforms, Frequency deviation, Phase deviation and Modulation index, Frequency spectrum of Angle modulated wave - Phase and Frequency modulator and demodulator, Direct FM transmitter, Indirect transmitters, Angle modulation versus Amplitude modulation, FM receivers and Frequency versus Phase Modulation.

UNIT III PULSE COMMUNICATION 9

Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width Modulation, Pulse Code Modulation, Delta Modulation, Differential Pulse Code Modulation, Merits and demerits. Concept of multiplexing:- Frequency Division Multiplexing and Time Division Multiplexing.

UNIT IV DATA TRANSMISSION 9

Base band signal receiver:- Error probability, Optimum and matched filter techniques and

Coherent reception. Digital modulation systems:- Amplitude Shift Keying, Frequency Shift Keying and Phase Shift Keying, Comparison of data transmission systems.

UNIT V COMMUNICATION SYSTEMS **9**

Introduction - Optical Communication System - Microwave communication system - Satellite Communication System. Television:- Scanning methods, B/W and colour systems – Camera and Picture tubes, Synchronization, Transmitters and Receivers.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the basic concept of Amplitude and Angle Modulation.
- gain knowledge on various modes of communication systems.

TEXT BOOKS

1. Singh, R.P. and Sapre, S.D., "Analog and Digital Communication Systems", McGraw- Hill Publishing Company Ltd., 2003.
2. Kennedy, G., "Electronic Communication Systems", McGraw-Hill, 4th Edition, 2003.
3. Gulati, R.P., "Modern Television Practice Principles, Technology and Servicing", New Age International Pvt. Ltd., 2002.

REFERENCE BOOKS

1. Taub and Schilling, "Principles of Communication Systems", 2nd Edition, McGraw-Hill, 1986.
2. Haykins, S., "Communication Systems", 4th Edition, John Wiley Inc., 2000.
3. Carlson, A.B., "Communication Systems", 3rd Edition, Tata McGraw- Hill, 2001.

EI8503 PRINCIPLES OF DIGITAL SIGNAL PROCESSING **L T P C 3 0 0 3**

OBJECTIVES :

The student should be made to:

- gain knowledge on continuous/Discrete time signals and systems.
- Understand different sampling techniques and effects of quantization.
- gain knowledge on discrete and fast Fourier transform algorithms and their applications.
- learn the concepts of IIR and FIR filters.

UNIT I CONTINUOUS SIGNALS AND SYSTEMS **9**

Classification of systems - Continuous, linear, time invariant, causal, stable systems - classification of signals - continuous , energy and power signals; mathematical representation of signals; spectra of standard signals.

UNIT II SAMPLING AND QUANTIZATION **9**

Sampling techniques - Quantization - Quantization error - Nyquist rate - Aliasing effect – Digital signal representation - Truncation - Overflow errors in numerical computation - Interpolation.

UNIT III DISCRETE TIME SIGNALS AND SYSTEMS **9**

Discrete Time system - Discrete linear and circular convolutions - Difference equations and solutions - Z-transform - Inverse Z-transforms - Stability of discrete time system- Frequency response – Standard discrete time signals and DTFT.

UNIT IV DISCRETE FOURIER TRANSFORM & FFT **9**

DFT properties, magnitude and phase representation - Direct computation of DFT, FFT - Radix 2 - DIT & DIF algorithms - Convolution - Application using FFT – Power spectrum.

UNIT V DESIGN OF DIGITAL FILTERS **9**

Butterworth approximation - Butterworth IIR lowpass digital filter using impulse invariant and bilinear transformation - FIR filters - linear phase filters - window design technique – Rectangular, Hamming Hanning and Kaiser windows – realization structures.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- analyze continuous/Discrete time signals and systems.
- Apply discrete and fast Fourier transform algorithms and understand the concepts of IIR and FIR filters.

TEXT BOOKS

1. Johonny R.Johnson, Introduction to Digital Signal Processing, Prentice Hall of India, 2009.
2. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, 2010.

REFERENCES

1. J.G.Proakis and D.G.Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson Education, New Delhi, 2003 / PHI.
2. S.K. Mitra, Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, 2001.
3. John P.Uyemura, A first course in Digital System Design An integrated approach, Cengage Learning, 2000.
4. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, Digital Signal Processing, Tata McGraw Hill, 2010.
5. Alan V. Oppenheim, Ronald W. Schafer and John R.Buck, Discrete-Time Signal Processing Pearson Education, New Delhi, 2003.

EI8504 **PROCESS CONTROL** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- develop the skills for obtaining the mathematical model of processes.
- analyze the dynamic model of different processes and to understand the difference between lumped and distributed parameter models.
- Know about the different control action and their relative merits, demerits and applications.
- gain knowledge on the construction, operation, characteristics and selection of control valves.
- learn the different tuning methods for PID controllers.
- Develop knowledge about the different multi loop control schemes and their applications.

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 : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- know about process dynamics, PID controllers and its tuning
- Gain knowledge about the construction, operation, characteristics and selection of control valves.
- Get familiarized with different multi loop control schemes and their applications.

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.

REFERENCE BOOKS:

1. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Proces Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003.
2 Coughanowr, D.R., "Process Systems Analysis and Control", McGraw - Hill International Edition, 2004.

EI8511 INDUSTRIAL INSTRUMENTATION LABORATORY **L T P C**
0 0 3 2

OBJECTIVES :

The student should be made to:

- gain knowledge on the measuring instruments for accurate measure of process variables(flow, level, temperature, viscosity and pressure)
- get understanding about the usage of various types of analytical instruments such as pH, Conductivity, UV absorbance and transmittance.
- Learn about the calibration of Bio-medical measuring instruments.

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
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

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- effectively use the measuring instruments for accurate measure of process variables(flow, level, temperature, viscosity and pressure) and Bio-medical measuring instruments using calibrators
- Get familiarized with the usage of various types of analytical instruments such as pH, conductivity, UV absorbance and transmittance.

EI8512 PROCESS CONTROL LABORATORY L T P C
0 0 3 2

OBJECTIVES :

The student should be made to:

- Learn the procedure for obtaining the servo and regulatory responses of process control loops such as level, pressure, flow and temperature.
- understand the procedure for obtaining the optimum controller settings using various tuning methods by experimental and mathematically described processes.
- learn and analyze the control schemes for multiloop processes such as three tank and four tank systems.

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:

At the end of the course, the student should be able to:

- conduct the experiments and obtain the servo and regulatory responses of process control loops such as level, pressure, flow and temperature.
- arrive the optimum controller settings using various tuning methods by experimental and mathematically described processes.
- analyze and design control schemes for multiloop processes such as three tank and four tank systems.

MG8651 ENGINEERING MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- To make the students aware of the outline of managerial functions relating to manufacturing.

UNIT I MARKETING AND PERSONNEL MANAGEMENT 7

Functions of Marketing – Sales Promotion Methods – Advertising – Product Packaging – Marketing Variables – Distribution Channels – Organization – Market research – Market Research Techniques. Functions of Personnel Management – Recruitment – Training – Leadership - Motivation – Communication – Conflict - Industrial Relations – Trade union – Management functions

UNIT II INVENTORY MANAGEMENT **10**

Purpose of Inventory – Cost Related to inventory – Basic EOQ Model – Variations in EOQ Model – Finite Production – Quantity Discounts – ABC Analysis – MRP – Lot size under constraints.

UNIT III OPERATIONS MANAGEMENT **9**

Plant Location – Layout – Materials Handling – Method Study – Time Study – Ergonomics – Aggregate Planning – Value Analysis.

UNIT IV FINANCIAL MANAGEMENT **8**

Capital – Types – Sources – Break Even Analysis – Financial Statements – Income Statement – Balance Sheet – Capital Budgeting – Working Capital Management – Inventory Pricing.

UNIT V OPERATIONS RESEARCH TECHNIQUES **11**

Replacement theory – Linear Programming - Transportation and assignment problems – Sequencing - Network Techniques - CPM and PERT.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- The students would be able to understand the basic application of operational tools and manufacturing.

TEXT BOOKS:

1. R.Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Management – Eswar Press, 2005
2. R.Panneerselvam – Operations Research – Prentice Hall of India, 2003.

REFERENCES:

1. Koontz and Odonnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995
3. I.M.Pandey – Financial Management, Vikas Publishing House, 1995
4. K.K.Ahuja – Personnel Management, Kalyane Publication 1992

5. K.Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003.
6. Martand T. Telesand – Industrial and Business Management – S.Chand & Co., 2001
7. R.Kesavan,C.Elanchezian and B.Vijayaramnath – Production Planning and Control Anuratha Publishing Co. Ltd., Chennai – 2008.

EI8601 ANALYTICAL INSTRUMENTS L T P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge on various Spectro Photometers.
- learn about the ion conductivity and dissolved component analyzer.
- Understand the principle and operation of important instrumental methods for chemical analysis of gas samples.
- understand the principle, types of applications of chromatography.
- Study about the construction and working principle of X-ray, Nuclear Magnetic Resonance and Mass spectroscopy

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-Planar 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, cyclic voltametry, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silica analyzer.

UNIT V NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES 9

NMR – Basic principles – NMR spectrometer – 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 – Applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- acquire knowledge on number of analytical tools which are useful for industrial analysis, drugs and pharmaceutical labs.
- Get exposed to different chromatographic techniques, NMR and dissolved component analyzers.

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, McGraw Hill, 2004.

REFERENCES

1. Braun, R.D., Introduction to Instrumental Analysis, McGraw – 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. Liptak, B.G., Process Measurement and Analysis, CRC Press, 2005.

EI8602 **COMPUTER CONTROL OF PROCESSES** **LT P C**
3 0 0 3

OBJECTIVES:

The student should be made to:

- study about the state space analysis for discrete data systems
- gain knowledge on parametric and non parametric methods of system identification.
- learn the procedure for designing various digital controllers
- Know about the steps for carrying out analysis and design of multiloop controllers for MIMO processes.
- Learn about the different multivariable controllers and their implementation issues.

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 - Decoupler

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:

At the end of the course, the student should be able to:

- carry out state space analysis for discrete data systems and able to design various digital controllers.
- Apply their knowledge on parametric and non parametric methods of system identification.
- Apply their knowledge on carrying out analysis and design of multiloop and multivariable controllers for MIMO processes.

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 McGrawHill, 2003.
3. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.

REFERENCE BOOKS

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, 2nd Edition, 2003.
3. E. Ikonen and K. Najim, " Advanced Process Identification and Control", Marcel Dekker, Inc. Newyork, 2002
4. P. Albertos and S. Antonio, " Multivariable Control Systems An Engineering Approach", Springer Verlag, 2004
5. Sigurd Skogestad, Ian Postlethwaite, **"**Multivariable Feedback Control: Analysis and Design", John Wiley and Sons, 2004.

EI8603 MICRO CONTROLLER BASED SYSTEM DESIGN L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- study about the PIC Microcontroller, its architecture and programming.
- gain knowledge about the interrupts and timer of PIC microcontroller.
- study and understand the peripherals and interfacing devices with microcontrollers.
- Get introduced to the concept of ARM processor, its architecture and programming.
- Learn the ARM processor organization, execution, implementation and applications.

UNIT I INTRODUCTION TO PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller – PIC 16C6x and PIC 16C7x Architecture – PIC 16cxx– - Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC microcontroller 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:

At the end of the course, the student should be able to:

- Get familiarized with PIC Microcontroller, its architecture and programming.
- gain knowledge about the interrupts ,timer and strings of PIC microcontroller.
- Gain knowledge about ARM processor, its architecture, programming and applications.

TEXT BOOKS:

1. Peatman, J.B., "Design with PIC Micro Controllers"" Pearson Education, 3rd Edition, 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 Pretice Hall of India, 2007.

HS8561	**EMPLOYABILITY SKILLS**	**L T P C**
	(LAB / PRACTICAL COURSE)	**0 0 2 1**

(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations

1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
2. Creating effective PPTs – presenting the visuals effectively
3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.

4. Preparing job applications - writing covering letter and résumé
5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REQUIREMENTS FOR A CLASS OF 30 STUDENTS

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD's and DVD's on relevant topics

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**.**

REFERENCE BOOKS

1. Dhanavel, S.P. 2010. English and Soft Skills. Hyderabad: Orient BlackSwan Ltd.
2. Corneilssen, Joep. How to Prepare for Group Discussion and Interview. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. *Group Discussion and Team Building*. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. *The ACE of Soft Skills*. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. Corporate Soft Skills. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. *Presentation Skills for Students*. New York: Palgrave Macmillan, 2004.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

EXTENSIVE READERS

1. Covey, Stephen R. The 7 Habits of Highly Effective People. New York: Free Press, 1989.
2. Bagchi, Subroto. The Professional. New Delhi: Penguin Books India, 2009.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com

EI8611 COMPUTER CONTROL OF PROCESSES LABORATORY L T P C

0 0 3 2

OBJECTIVES :

The student should be made to:

- learn the procedure to obtain the dynamic model of given process using parametric and non parametric identification methods.
- design appropriate controllers for processes such as conical tank system, heat exchanger, AC DC servo system and four tank system.
- perform Sequential logic programming for discrete control applications and implement the same using PLCs.
- develop and implement control strategies in Industrial DCS and implement the schemes on level process Test Setup.
- study the procedure to build soft sensors using Kalman Filter

LIST OF EXPERIMENTS

1. Simulation of Lumped and Distributed Parameter Systems.
2. Identification of Linear Dynamic model (Black Box) of a Process using Parametric Methods.
3. Design of Digital Controllers for First-order plus dead-time process using Direct Synthesis Methods
4. PC based Control of Heat Exchanger.
5. Study of Distributed Control System (Delta V and CS 3000).
6. Implementation of Discrete Control Sequence using PLC.
7. Control of Level Process using Embedded Controller.
8. On-line Control using Distributed Control System.

9. Design of Gain Scheduled PI Controller Conical - tank System.
10. Study of AC and DC Servo Control System
11. Design and Implementation of Dynamic Matrix Control Scheme on the simulated model of a Four-tank System.
12. On-line Estimation of State Variables using Kalman Filter

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- develop dynamic model and control of given process using parametric and non parametric identification methods.
- Get familiarised with Sequential logic programming for discrete control applications and implement the same using PLCs.
- Gain knowledge to develop and implement control strategies in Industrial DCS and implement the schemes on level process Test Setup.

EI8701 LOGIC AND DISTRIBUTED CONTROL SYSTEM L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- study the fundamentals of Data Networks.
- gain knowledge about hardware architecture and software for PLCs and SCADAs.
- design PLC program using ladder logic programming, functional block programming and sequential functional chart for selected Industrial processes.
- study the Distributed Control System, its architecture and interfacing.
- Learn about selective Industrial data communication protocols such as HART and field bus communication suitable for an industrial application.

UNIT I DATA NETWORK FUNDAMENTALS 9

Network hierarchy and switching – ISO/OSI Reference model – Data link control protocol:- HDLC - media access protocol :- Command / response, Token passing and CSMA/CD – TCP/ IP – Bridges – Routers – Gateways – Standard ETHERNET and ARCNET Configuration.

UNIT II PLC AND SCADA 9

Evolutions of PLCs – Sequential and Programmable Controllers – Architecture – Comparative

study of Industrial PLCS. – SCADA:- Hardware and software, Remote terminal units, Master station, Communication architectures and open SCADA protocols.

UNIT III PLC PROGRAMMING **9**

Plc Programming:- Ladder logic , Functional block programming, sequential function chart, Instruction list.

UNIT IV DISTRIBUTED CONTROL SYSTEM **9**

DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Displace study of any one DCS available in market - case studies in DCS

UNIT V HART AND FIELD BUS **9**

Introduction – Evolution of Signal standard – HART Communication Protocol – Communication Modes – HART Commands – HART Applications Field Bus-Introduction, General field bus Architecture, Basic requirements of Field bus standard, Field Bus topology, Interoperability and Interchangeability – Introduction to OLE for process control(OPC)

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Get familiarised to fundamentals of Data Networks and select Industrial data communication protocols such as HART and field bus communication suitable for an industrial application.
- Acquire knowledge about hardware architecture, software and programming of PLCs.
- Get exposed to Distributed Control System, its architecture and interfacing.

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. Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP3,
4. 60870.5 and Related Systems”, Newnes, 1st Edition, 2004

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. Bowten, R "HART Application Guide", HART Communication foundation, 1999 .
6. Berge, J.,"Field Busses for process control: Engineering, operation,maintance", ISA press, 2004

EI8702 VLSI DESIGN LT P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge about the characteristics of CMOS, NMOS and their fabrication.
- learn and design rules and layout for NMOS and CMOS.
- understand FPGA, CPLD and their architectures.
- Study about the principle of HDL, its synthesis, validation and verification.
- Gain practical knowledge on VHDL programming of combinational and sequential logic circuits

UNIT I BASIC DEVICE CHARACTERISTICS 9

NMOS, PMOS, enhancement and depletion mode transistor, MOSFET threshold voltage, linear and saturated operation, standard NMOS and CMOS inverters- switching speed, transistor sizing and power dissipation, noise margin. Pass transistors and Transmission gates. CMOS device fabrication principles, CMOS latch-up. SPICE models and circuit simulation using PSPICE

UNIT II DESIGN RULES AND LAYOUT 9

Purpose of design rules, NMOS and CMOS design rules and layout, Design of NMOS and CMOS inverters, NAND and NOR gates. Interlayer contacts, butting and buried contacts, stick diagrams, layout of parity generator, multiplexer and adder element. Design and layout of 1

bit shift register cell.

UNIT III FPGAs AND CPLDs **9**

Introduction to FPGA Architectures. SRAM-Based FPGAs. Permanently Programmed FPGAs. I10 cell, Introduction to CPLDs. FPGAs and CPLDs from Xilinx, Altera and Actel. Introduction to ASIC.

UNIT IV PRINCIPLES OF HDL **9**

VHDL design flow Entity- Signal and Variable – Using Subcircuits - Concurrent Assignment Statements – Sequential Assignment Statements. High level VLSI synthesis and design tools with CAD algorithm - Overview for floor planning, placement and routing.

UNIT V VHDL PROGRAMMING **9**

VHDL programs of encoder, decoder, multiplexer, adders, shift registers, counters and accumulator. Realizing PID controller in VHDL. Use of VHDL in process control applications.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Gain knowledge about the characteristics and design rules for CMOS, NMOS
- Get exposed to FPGA, CPLD, their architectures and capable of carrying out VHDL programming of combinational and sequential logic circuits
- understand the principle of HDL, its synthesis, validation and verification.

REFERENCES

1. Jan M.Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated circuits – A design perspective, Second Edition, Prentice hall of India ,2003.
2. Stephen Brown, Zvonko Vranesic, Fundamentals of Digital Logic with VHDL design, International edition 2000.
3. Douglas A. Puchnell and Kamran Eshraghian, Basic VLSI design,Third edition, Prentice Hall of India, 2004.
4. Michael John Sebastian Smith, Application-Specific Integrated Circuits, Addison-Wesley, June 1997.
5. Uyemura, John P, Introduction to VLSI Circuits and Systems,1st Edition, John Wiley and sons,2001.
6. Wayne Wolf, FPGA – Based System Design, Prentice Hall , 2004.

EI8703 **BIOMEDICAL INSTRUMENTATION** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- understand the various physiological signal measurements and various assisting devices.
- Gain knowledge about the recording of ECG, EEG,EMG and ERG signals and their analysis.
- learn about the techniques used for measurement of Blood, heart, lung and liver related parameters.
- Study different medical imaging systems and its applications.
- understand the concept of assisting and therapeutic devices.

UNIT I BASIC CONCEPTS OF MEDICAL INSTRUMENTATION 6

Terminology of medicine and medical devices - Generalized medical Instrumentation systems - Medical measurement constraints - Classification of Biomedical instruments - Interfering and modifying inputs - Compensation Techniques-Bio-statics - Generelized static characteristics - Generalized Dynamic Characteristics - Design criteria - Transducers Selection criteria. The origin of Biopotentials - Electrical activity of excitable cells - Volume conductor fields - Functional organization of peripheral Nervous system

UNIT II ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 12

Biopotential Electrodes - The electrode-Electrolyte interface - Polarization – Polarizable and non polarizable electrodes - Electrode behavior and circuit models-Electrode arrays - Microelectrodes. Electrical parameters acquisition - 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 III NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output – blood flow - 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 IV MEDICAL IMAGING SYSTEMS **9**

X-ray machine- computer radiography - computer tomography - magnetic resonic imaging – Neuclear medicine – single photo emission computer tomography – positron emission tomography – Ultra sonography – Endoscopy – Thermography .

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES **9**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - Therapeutic and Prosthetic Devices – Infant Incubators – Drug Delivery Devices – Surgical Instruments.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- gain knowledge about the recording of ECG, EEG,EMG and ERG signals and their analysis.
- Get familiarized about the techniques used for measurement of Blood, heart, lung and liver related parameters.
- Gain knowledge on different medical imaging systems and its applications.

TEXT BOOKS:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.

REFERENCES

1. Ed. Joseph D. Bronzino, The Biomedical Engineering HandBook, Second Edition, Boca Raton, CRC Press LLC, 2000
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 1997.
3. Duane Knudson, Fundamentals of Biomechanics, Springer, 2003.
4. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
5. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 1997.

EI8711	CREATIVE AND INNOVATIVE PROJECT	L T P C
	(Activity based – Subject related)	0 0 3 2

OBJECTIVES:

- To use the knowledge acquired in Electrical and Electronics Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

STRATEGY:

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs.

OUTCOMES:

- Obtain the skills of conducting literature survey.
- Learn different field problems pertaining to Electrical Engineering and the existing solutions to them.
- Providing new or innovative solutions with the advent of emerging technologies
- Acquire hardware fabrication skills.

EI8712	SYSTEM DESIGN LABORATORY	L T P C
		0 0 3 2

OBJECTIVES :

The student should be made to:

- design Instrumentation amplifier, active filters, RPS and signal converters.
- design and implement the signal conditioning circuits for transducers such as RTD, strain gauge and thermocouple.
- gain knowledge on the design and implementation of orifice plate, Rotameter, control valves and Differential pressure transmitter.
- design and implement PID controller using operational amplifiers, microprocessors and multichannel data acquisition system.
- learn the procedure to prepare P&I diagram and documentation of the project work on selected industrial processes

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 multirange 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. One or two experiments beyond syllabus

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Get exposed to the design and implementation of flow meters and to design signal conditioning circuits for transducers such as RTD, strain gauge and thermocouple.
- design and implement PID controller using operational amplifiers, microprocessors and multichannel data acquisition system.

EI8811	PROJECT WORK	L T P C 0 0 12 6

OBJECTIVES :

The student should be made to:

- learn methodology to select a good project and able to work in a team leading to development of hardware/software product.
- prepare a good technical report.
- Gain Motivation to present the ideas behind the project with clarity.

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

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 jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

OUTCOMES:

At the end of the course, the student should be able to:

- select a good project and able to work in a team leading to development of hardware/software product.
- prepare a good technical report and able to present the ideas with clarity.

EI8001	ADVANCED CONTROL ENGINEERING	L T P C 3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge on the methods of plotting Nyquist chart for multivariable system.
- develop state space models.
- design state feedback control schemes and state observers.
- learn the different types of non-linearities and phase plane analysis.

- understand the different methods of determining the stability of non-linear systems.

UNIT I FREQUENCY DOMAIN DESCRIPTIONS 9

Properties of transfer functions - poles and zeros of transfer function matrices – singular value analysis – Multivariable Nyquist plots.

UNIT II STATE SPACE APPROACH 9

Review of state model for systems – State transition matrix and its properties – free and forced responses – controllability and observability – Kalman decomposition – minimal realization – balanced realization.

UNIT III STATE FEEDBACK CONTROL AND STATE ESTIMATOR 9

State Feedback – Output Feedback – Pole placement technique – Full order and Reduced Order Observers – Deadbeat Observers – Dead beat Control

UNIT IV NON-LINEAR SYSTEMS 9

Types of Non-Linearity – Typical Examples – Phase plane analysis (analytical and graphical methods) – Limit cycles – Equivalent Linearization – Describing Function Analysis, Derivation of Describing Functions for different non-linear elements.

UNIT V STABILITY OF NON-LINEAR SYSTEMS 9

Stability concepts – Equilibrium points – BIBO and Asymptotic stability – Stability Analysis by DF method – Lyapnov Stability Criteria – Krasovskil's method – Variable Gradient Method – Popov's Stability Criterion.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- analyze MIMO systems methods of plotting Nyquist chart for multivariable system.
- analyze the state space models and capable to design state feedback control schemes and state observers.

TEXT BOOK:

1. K.Ogata, “Modern Control Engineering”, PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. C.T. Chen, “Linear System Theory and Design”, Prentice Hall, 3rd Edition, 2003
2. M.Gopal, “Modern Control System Theory”, Wiley Eastern Limited, 2nd edition, 1996.
3. W. L. Luyben, “Process Modeling, Simulation and Control for Chemical Engineers”, 2nd edition, McGraw Hill, 1990.
4. D.P.Atherton, “Stability of non linear systems”, Prentice Hall, 1986.

EI8002	APPLIED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES :

The student should be made to:

- learn about different random signals and random processes.
- gain knowledge on different methods of spectrum estimation.
- understand the concepts of linear estimation and prediction.
- Know the procedure for design of different types of adaptive filters.
- Mathematically represent transfer function of signals using wavelet transforms and their applications.

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 – Derivation of first order adaptive filter – LMS adaptation algorithms – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellers.

UNIT V WAVELET TRANSFORM 9

Short Time Fourier Transform - Continuous and discrete wavelet transform – Multi-resolution analysis, Application of wavelet transform - Cepstrum and Homomorphic filtering.

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to:

- understand the concept of multirate signal processing and random signal processing

TEXT BOOKS:

1. Monson H, Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Second Edition, 2004.

REFERENCES:

1. John G.Proakis, Dimitris G. Manolakis, Digital Signal Processing, Pearson, Fourth 2007.
2. Sophocles J. Orfanidis, Optimum Signal Processing, An Introduction, McGraw Hill, 1990.

EI8003 **APPLIED SOFT COMPUTING** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- study the fundamentals of Neural networks and their architecture.
- gain knowledge on the applications of Neural networks for modelling and control.
- Get introduced to the concept of fuzzy set theory
- Understand Fuzzy logic theory for modelling and control.
- Develop hybrid control Schemes and apply optimization algorithms.

UNIT I ARTIFICIAL NEURAL NETWORK **9**

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back propagation algorithm (BPA) – Recurrent neural network (RNN) – Adaptive resonance theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – RTRL algorithms – Reinforcement learning.

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL **9**

Modeling of non-linear systems using ANN – Generation of training data – Optimal architecture – Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox

UNIT III FUZZY SET THEORY **9**

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL **9**

Modeling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox

UNIT V HYBRID CONTROL SCHEMES **9**

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron

– Introduction to GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to support vector machine – Particle swarm optimization – Case study – Familiarization with ANFIS toolbox

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the different ANN architecture and concept of Fuzzy Logic theory and their applications in modeling and control
- Get familiarity with hybrid control Schemes and selected optimization algorithms.

TEXTBOOKS

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 1997.

REFERENCE BOOKS

1. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989.
2. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992
3. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)', MIT Press, 2004
4. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

EI8004	DATA BASE MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES :

The student should be made to:

- understand the concepts of relational database system.
- gain knowledge about the design aspects of Database system
- gain the concept of transactions in Database
- learn the different techniques used for data storage
- know the current trends in object oriented database management system.

UNIT I RELATIONAL DATABASES **9**

Purpose of database system – Views of data – Data models – Database system architecture – Relational databases – The relational model – Keys – Relational algebra – Relational Calculus – SQL fundamentals – Advanced SQL features – Views

UNIT II DATABASE DESIGN **9**

Entity-Relationship (ER) model – ER diagrams – Normalization – Functional dependencies – Non-loss decomposition – First, second, third normal forms and Boyce/ Codd normal form – Integrity and security – Triggers

UNIT III TRANSACTIONS **9**

Transaction concepts – ACID properties – Transaction recovery – Log based recovery – Concurrency – Need for concurrency – Locking protocols – Two phase locking – Deadlock – Recovery isolation levels – SQL facilities for concurrency

UNIT IV STORAGE TECHNIQUES **9**

Overview of physical storage media – Magnetic disks – RAID – Tertiary storage – File organization – Organization of records in files – Indexing and hashing – Ordered indices – B+ tree index files – B tree index files – Static hashing – Dynamic hashing

UNIT V ADVANCED TOPICS **9**

Query processing – Query optimization – Distributed databases – Architecture – Distributed transaction processing – Two phase commit protocol - Data warehousing and mining – Data warehouse architecture – Star and snowflake schema – Data extraction – Transformation – Cleaning – Loading into a data warehouse – Data mining fundamentals

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand relational database system and its design aspects.
- acquire the knowledge about the different techniques used for data storage and capable of understanding the current trends in object oriented database management system.

TEXTBOOKS:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, Database System Concepts, Sixth edition, Tata McGraw Hill, 2011
2. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Eighth edition, Pearson Education, 2006

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Fifth edition, Pearson, 2008
2. Raghu Ramakrishnan, Database Management Systems, Third edition, Tata McGraw Hill, 2003
3. G. K.Gupta, Database Management Systems, Tata McGraw Hill, 2011

EI8005 FIBRE OPTICS AND LASER INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- study about the transmission characteristics of light and principles of TRI in optical fibers.
- Understand about the types of optical fibres and its applications for the measurement of pressure, temperature, level and strain etc.
- Know about the fundamentals of laser system, its mode of operation and their classifications.
- learn the applications of laser for measurement of distance, velocity etc and material processing.
- understand the principles of Holography, its application in NDT and the use of laser in biomedical application.

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fibre-laws related to light propagation through fibre - Different types of fibers and their properties, Fibre manufacture -- mechanical and transmission characteristics – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors – Fibre optic instrumentation system for measurement of fibre characteristics – Different types of modulators – Interferometric method for measurement of length – Moire

fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain – fiber optic gyroscope – Polarization Maintaining fibers.

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,Excimer lasers,VCSEL.

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 – 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 interaction – Laser instruments for surgery - removal of tumours of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the types of optical fibres and its application as fiber optic sensors
- Get familiarized on the applications of laser for measurement of distance, velocity, material processing, NDT and biomedical applications .

REFERENCE BOOKS:

1. G. Keiser, ‘Optical Fibre Communication’, McGraw Hill, 1995.
2. Singh,J., “Semi conductor optoelectronics”, McGraw Hill,1995.
3. John F. Ready, ‘Industrial Applications of Lasers’, Academic Press, 1978.
4. Monte Ross, ‘Laser Applications’, McGraw Hill, 1968
5. John and Harry,” Industrial lasers and their application”, McGraw Hill, 2002.

EI8006 FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- study the basics of data structures such as arrays, queues etc.
- gain knowledge about the advantages of data structures.
- learn the procedure to select appropriate sorting algorithms for a given application.
- study the basics of graph, its representation and implementation.
- understand storage structures and management.

UNIT I INTRODUCTION AND BASIC DATA STRUCTURES 9

Introduction – Arrays – Structures – Stacks and queues – Linked list – Array, list implementation and applications

UNIT II ADVANCED DATA STRUCTURES 9

Trees, preliminaries – Binary tree – Tree representation – Tree traversals - Binary search trees

UNIT III SORTING AND HASHING 9

Need for sorting – Selection sort – Insertion sort – Exchange sort – Merge and radix sort – Heap sort – Heaps – Maintaining the heap property – Building a heap – Heap sort algorithm –Quick sort – Description – Performance of quick sort – Analysis of quick sort

UNIT IV GRAPHS ALGORITHMS 9

Graphs – Application of graphs – Representation – Dijkstra's algorithm – Minimum spanning trees – Single-source shortest paths – All pairs shortest paths

UNIT V STORAGE STRUCTURES AND MANAGEMENT 9

Indexing – B-Tree indexing – Hashing – General idea – Hash functions – Separate chaining –Open addressing – Rehashing – Extendible hashing – Garbage collection and compaction

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Get familiarized with fundamentals of data structures used in computer science and able to design new algorithms or modify the existing ones for new applications.

TEXTBOOKS:

1. A.S. Tanenbaum, Y. Langram and M. J. Augestiein, Data Structures using C, Second edition, Pearson Education, 2008
2. E. **Horowitz,** S. Sahni and Anderson-Freed, Fundamentals of ***Data Structures*** in C, Second edition, University Press, 2007.

EI8007 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- learn and understand the fundamentals of digital image.
- gain knowledge on how images are enhanced to improve subjective perception.
- understand image restoration techniques.
- gain knowledge on image segmentation.
- study the principle of image compression.

UNIT I FUNDAMENTALS OF DIGITAL IMAGE 9

Elements of digital image processing systems - Vidicon and Digital Camera working principles - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect - Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT 9

Histogram equalization and specification techniques - Noise distributions - Spatial averaging - Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters - Homomorphic filtering - Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Unconstrained and Constrained restoration, Inverse

filtering - Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations - Spatial transformations.

UNIT IV IMAGE SEGMENTATION **9**

Edge detection - Edge linking via Hough transform - Thresholding - Region based segmentation - Region growing - Region splitting and Merging - Segmentation by morphological watersheds - basic concepts - Dam construction - Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION **9**

Need for data compression - Huffman, Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Transform coding - JPEG standard - MPEG.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Gain knowledge about how image are enhanced to improve subjective perception.
- understand the image restoration techniques.
- Gain knowledge on image segmentation and compression.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Education, Inc., Second Edition, 2004.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, Inc., 2002.

REFERENCES:

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Madhuri A. Joshi, Digital Image Processing - An Algorithmic Approach", Prentice Hall of India, 2006.
3. S.Jayaraman , S.Esakkirajan, T.Veerakumar, " Digital Image Processing", Tata McGraw Hill, 2009.

EI8008 FUNDAMENTALS OF NANOSCIENCE AND MEMS **L T P C**

3 0 0 3

OBJECTIVES :

The student should be made to:

- learn about nano science technology and its engineering applications.

- gain knowledge on different micro fabrication methods
- learn the concept of patterning and lithography for nano scale devices

- know about environmental requirements for nano fabrication facilities
- understand different techniques for nano scale characterisation

UNIT I INTRODUCTION 10

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 PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARECTERISATION TECHNIQUES 10

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

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- gain knowledge on different micro fabrication methods and get exposed to patterning and lithography for nano scale devices
- understand different techniques for nano scale characterisation

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 charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

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

EI8009 INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- understand the different oil recovery methods, oil gas separation and its processing.
- learn about the most important unit operations in petrochemical industries like cracking, reforming etc.
- gain knowledge on the important derivatives obtained from petroleum and its uses.
- Know about the most important variables to be monitored and measured in petrochemical industry and steps followed for ensuring intrinsic safety.
- study about the different control schemes applied to processes like distillation column, PVC production unit, cracking and reforming.

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 Electrotechnical 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:

At the end of the course, the student should be able to:

- understand the oil recovery methods, oil gas separation and the important derivatives obtained from petroleum and its uses.
- gain knowledge on the most important variables to be monitored, measured and controlled on selected unit operations in petrochemical industry

TEXT BOOKS:

1. Balchen J.G and Mumme K.I., Process Control Structures and Applications, Von Nostrand Reinhold Company, New York, 1988.
2. www.scribd.com/doc/2336259/ABB-Oil-Gas-production-Hand-Book.

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. Ram Prasad, Petroleum Refining Technology, Khanna Publishers, New Delhi, 2000.

EI8010 **OPTIMIZATION TECHNIQUES** **L T P C**

3 0 0 3

OBJECTIVES :

The student should be made to:

- learn the procedure to numerically solve different classes of optimization algorithms using appropriate optimization techniques (Linear, Non linear and dynamic)
- understand procedure to select appropriate optimization algorithms for a given application
- gain knowledge about genetic Algorithms and its application in process control and instrumentation.

UNIT I INTRODUCTION **9**

Historical Development, Engineering application of Optimization, Formulation of design problems as mathematical programming problems, classification of optimization problems.– Case studies

UNIT II LINEAR PROGRAMMING **9**

Graphical method, Simplex method, Revised simplex method, Duality in linear programming (LP), Transportation, assignment and other applications.

UNIT III NON LINEAR PROGRAMMING **9**

Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and indirect methods, Optimization with calculus, Khun-Tucker conditions.

UNIT IV DYNAMIC PROGRAMMING **9**

Introduction, Sequential optimization, computational procedure, curse of dimensionality, Applications in Control Engineering

UNIT V ADVANCED TECHNIQUES OF OPTIMIZATION **9**

Introduction- Genetic algorithms for optimization and search – Multi-objective evolutionary optimzation - The role of Pareto - optimal problems in Engineering Design and their solution strategies based upon Genetic Algorithms – Usage in process control- Particle Swarm Optimization

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- solve numerically different classes of optimization algorithms using appropriate optimization techniques (Linear, Non linear and dynamic) and able to select appropriate optimization algorithms for a given application

TEXT BOOK :

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International (P) Ltd., New Delhi, 2000.

REFERENCE BOOKS:

1. K. Deb, "Optimization for Engineering Design – Algorithms and Examples", Prentice- Hall of India Pvt. Ltd., New Delhi, 5th Edition, 2004.
2. K. Deb, "Multi-Objective Optimization Using Evolutionary Algorithms", John Wiley & Sons (ASIA) Private Ltd. Singapore, 2004

EI8011	POWER ELECTRONICS DEVICES AND CIRCUIT	L	T	P	C
		3	0	0	3

OBJECTIVES :

The student should be made to:

- understand the operation of controlled rectifiers, choppers, inverters and their applications.
- learn the principle of step up and step down choppers
- study about voltage source inverter, current source inverter and PWM.
- Gain knowledge about the applications of power semiconductor devices for the speed control of AC and DC motors.

UNIT I POWER SEMICONDUCTOR DEVICES AND CHARACTERISTICS 9

Operating principle and switching Characteristics - Power diodes - Power BJT, Power MOSFET, IGBT, SCR,TRIAC, GTO, IGCT, MCT, Power integrated circuits (PIC) – Drive and Protection circuits – Series and parallel operation of power devices – Commutation –Simulation tools.

UNIT II CONTROLLED RECTIFIERS **9**

Single phase – Three phase – Half controlled – Fully controlled rectifiers – Dual converters - Effect of source and load inductance - AC voltage controllers – Phase control, Cycloconverters PWM control, Transformer tap changers, Matrix converters.

UNIT III CHOPPERS **9**

Step up and Step down Chopper – Chopper classification - quadrant of operation – Switching mode Regulators - Buck, Boost, Buck-Boost, and Cuk Regulators.

UNIT IV INVERTERS **9**

Voltage source Inverters - Bridge Inverters – Half bridge – Full bridge – Three Phase Bridge Inverters - Voltage control – PWM Techniques – Current Source Inverters: –Capacitor Commutated Inverter- Resonant inverters - Series, Parallel, Class E, ZVS, ZCS, DC link -Introduction to multilevel Inverters.

UNIT V APPLICATION **9**

Introduction to D.C and A.C drives – Electrical breaking - Open loop and Closed loop control of drives (Block diagram approach only) – Principle of vector control of AC drives - Stepper motor drives - Switched mode power supply - Introduction to HVDC and FACTS - Static VAR compensators.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the operation of controlled rectifiers, choppers, inverters and their applications and gain knowledge in selection of power semiconductor devices for the speed control of AC and DC motors.

TEXT BOOKS:

1. Rashid, M.H., “Power Electronics – Circuits, Devices and Applications”, PHI, 3rd Ed., 2004.
2. Mohan, Udeland and Robbins., “Power Electronics”, John Wiley and Sons, New York,1995.

REFERENCE BOOKS:

1. Singh, M.D. Khanchandani, K.B., “Power Electronics”, 2nd Ed., Tata McGraw-Hill, 2011.

2. Bose, B.K., “Modern Power Electronics and AC Drives”, Pearson Education, 2002.
3. Bimbra, P.S, “ Power Electronics”, Khanna Publishers, 2006.
4. Moorthi, V.R., “Power Electronics - Devices, Circuits and Industrial Applications”, Oxford University Press, 2005

EI8012 REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge on the selection of processor and software for embedded applications
- learn about the serial and parallel communication protocols.
- understand interrupt service mechanism and device drivers
- know the procedure to design RTOS based embedded system
- acquire knowledge on selected embedded system applications.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Build process for embedded systems - Structural units in Embedded processor , selection of processor & memory devices - DMA – memory mapping - Timer and Counting devices, Watchdog Timer, Real Time Clock - Software Embedded in a system - IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, Boundary Scan.

UNIT II EMBEDDED NETWORKING 9

Embedded Networking: Introduction, I/O Device Ports – Serial Bus communication protocols - RS232 standard – RS485 – CAN Bus – RS485 - Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) – PC Parallel port communication Protocols - network using ISA, PCI - Wireless and Mobile System Protocols.

UNIT III DEVICE DRIVERS AND INTERRUPTS SERVICE MECHANISM 9

Programmed - I/O busy-wait approach without interrupt service mechanism - ISR concept - interrupt sources – multiple interrupts – context and periods for context switching, interrupt latency and deadline – Device Driver – Introduction to Basic Concept of Parallel port & Serial port Device Drivers.

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 - Interprocess Communication – Synchronization between processes - Semaphores, Mailbox, Pipes, Priority inversion, Priority inheritance, Comparison of Real time Operating systems: VxWorks, μC/OS-II, RT Linux.

UNIT V EMBEDDED SYSTEM APPLICATION WITH DEVELOPMENT 9

Case Study of Washing Machine- Automotive Application – RFID - System, Application, Tag, Reader - Embedded Product Development Life Cycle, Objective, Need, different Phases & Modelling of the EDLC.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Gain knowledge on selection of processor and software for embedded applications and get exposed to serial and parallel communication protocols.
- design RTOS based embedded system

TEXT BOOKS:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TataMcgraw Hill, 2011.
2. Peckol,"Embedded System Design", John Wiley,2010.

REFERENCES:

1. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
2. Han-Way Huang, "Embedded system Design using C8051", Cengage Learning, 2009
3. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007
4. Shibu.k.v, "Introduction to Embedded Systems", TataMcgraw Hill, 2009

EI8013 REAL TIME OPERATING SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- study the concepts of embedded programming and its implementation using C,C++
- learn the services provided by real time Operating systems.

- know about inter task communication and synchronization.
- understand Micro COS-11 and Vx works and its supported system level functions.
- learn the concept of RTOS using typical case studies.

UNIT I CONCEPTS AND EMBEDDED PROGRAMMING IN C, C++ 10

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

UNIT II REAL TIME OPERATING SYSTEMS– PART - 1 11

Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organisation and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks - INTER PROCESS

UNIT III COMMUNICATION AND SYNCHRONISATION 8

Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs).

UNIT IV REAL TIME OPERATING SYSTEMS – PART - 2 9

Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions –

UNIT V CASE STUDIES 7

Case Studies of Programming with RTOS – Understanding Case Definition – Multiple Tasks

and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the concepts of embedded programming and its implementation using C,C++ and get exposed to Micro COS-11 and Vx works and its supported system level functions.
- Understand the concept of RTOS using typical case studies.

TEXT BOOKS

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, First reprint Oct. 2003

REFERENCES

1. Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001
4. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware / Software Introduction, John Wiley, 2002.

EI8014 ROBOTICS AND AUTOMATION L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- To study and understand the evolution of robot technology and their classification.
- To introduce the methodology for mathematical representation of different types of robots.
- To acquire knowledge on construction of manipulators and their types.
- To learn the procedure for carrying out kinematics and path learning techniques.
- To expose knowledge on the case studies and design of robot machine interface.

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 - PUMA 560 & 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 - 2 DOF Manipulator - Lagrange Euler formulation - Dynamic model -Manipulator control problem - Linear control schemes - PID control scheme - Force control of robotic manipulator

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand the evolution of robot technology and mathematically represent different types of robot.
- Get exposed to the case studies and design of robot machine interface.

TEXTBOOKS

1. R. K. Mittal and I. J. Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005
2. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009

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. M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996
6. B.K. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998

EI8015 SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- understand non parametric methods of system identification
- gain knowledge about different types of parametric estimation methods such as prediction error and instrumental variable methods.
- Learn about the recursive identification methods and their applications
- Know the design procedure of adaptive control schemes for linear and non linear systems
- explore the case studies on adaptive control system

UNIT I NON PARAMETRIC METHODS 9

Nonparametric 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 IN ADAPTIVE CONTROL AND APPLICATIONS 9

Stability – Convergence – Robustness – Applications of adaptive control

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- understand parametric and non parametric methods of system identification
- design appropriate adaptive control schemes for linear and non linear systems and get exposed to case studies of adaptive control system

TEXT BOOKS:

1. Soderstorm T and Peter Stoica, System Identification, Prentice Hall International, 1989.
2. Astrom, K.J. and Wittenmark, B., “Adaptive Control” , Pearson Education, 2nd Edition, 2001

REFERENCES:

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Englewood Cliffs,1987.
2. Sastry, S. and Bodson, M., “Adaptive Control – Stability, Convergence and Robustness”, Prentice Hall inc., New Jersey, 1989

EI8016 THERMAL POWER PLANT INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge about different types of power plants.
- study about the methods used for measurement of process variables related to thermal power plant.
- learn the different control schemes for boiler and its auxiliary units.
- study the concept of burner management system.
- Understand the different configuration of turbine control system.

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:

At the end of the course, the student should be able to:

- gain knowledge about different types of power plants, measurements involved in thermal power plant.
- understand the different control schemes for boiler, turbine and their auxiliary units.

TEXT BOOKS

1. Sam Dukelow, Control of Boilers, Instrument Society of America, 1991.
2. Krishnaswamy.K and Ponnibala.M., Power Plant Instrumentation, PHI Learning Pvt. Ltd., New Delhi, 2011.

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.

EI8017 UNIT OPERATIONS AND CONTROL L T P C

3 0 0 3

OBJECTIVES :

The student should be made to:

- study the unit operations involved for transportation, mixing and separation.
- Understand the basic operations involved with heat exchangers, evaporators and crystallisers.
- gain knowledge on the operation of dryers, distillation column, refrigerators and chemical reactors.
- study about the different unit operations involved in paper and pulp,steel industry, thermal power plant, pharmaceutical and leather industries

UNIT I UNIT OPERATIONS 9

Unit operations-transport of liquids, solids and gases adjusting particle size of bulk solids – mixing processes – separation processes.

UNIT II COMBUSTION PROCESSES **9**

Combustion processes – heat exchangers – energy balance material balance – evaporators –crystallization.

UNIT III OTHER OPERATIONS **9**

Drying – distillation – refrigeration process – chemical reactions.

UNIT IV CASE STUDY – I **9**

Operations in the manufacture of paper and pulp – operations in steel industry.

UNIT V CASE STUDY – II **9**

Operations in thermal power plant – operations in pharmaceutical industry and leather industry.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- gain knowledge of unit operation involved for transportation mixing and separation, heat exchangers, evaporators, crystallizers etc.
- Gain knowledge on unit operations involved in paper & pulp, steel, thermal power plant, pharmaceutical and leather industry

TEXT BOOK:

1. Balchen J.G. and Mumme, K.J., Process Control structures and applications, Van Nostrand Reinhold Co., New York, 1988.

REFERENCES:

1. Waddams, A.L., Chemicals from petroleum, Butler and Tanner Ltd., UK, 1968.
2. Austin, G.t. shreve's Chemical Process industries, McGraw-Hill International student edition, Singapore, 1985.
3. Liptak, B.G., Process measurement and analysis, Chilton Book Company, USA, 1995
4. Luyben W.C., Process Modelling, Simulation and Control for Chemical Engineers, McGraw-Hill International edition, USA, 1989.

EI8018 **VIRTUAL INSTRUMENTATION** **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge about basic concepts in Virtual Instrumentation and its related software.
- understand the concepts of Data acquisition, Timers and Counters for carrying out real time projects.
- study about the different communication networked modules
- know the procedure and implementation of modelling and control of real time processes in LabVIEW Platform..
- learn PC based digital storage oscilloscope, spectrum analyser, distributed monitoring and control devices.

UNIT I INTRODUCTION **9**

Virtual Instrumentation: Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Virtual Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES **9**

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

UNIT III DATA ACQUISITION **9**

Introduction to data acquisition, Sampling fundamentals, Input/Output techniques and Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements – Issues involved in selection of Data acquisition cards – Data acquisition cards with serial communication - VI Chassis requirements. SCSI, PCI, PXI system controllers, Ethernet control of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT IV VI TOOLSETS **9**

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Application of VI in process control designing of equipments like oscilloscope,

Digital multimeter, Design of digital Voltmeters with transducer input. Virtual Laboratory, Web based Laboratory

UNIT V APPLICATIONS **9**

Distributed I/O modules - Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing,

Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Gain knowledge about basic concepts in Virtual Instrumentation and ability to design and implement process.
- Get exposed to PC based digital storage oscilloscope, spectrum analyser, distributed monitoring and control devices.

TEXTBOOKS:

1. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.

REFERENCES:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.

EI8071 INDUSTRIAL DATA NETWORKS **L T P C**
3 0 0 3

OBJECTIVES :

The student should be made to:

- gain knowledge on the serial interface standards.
- understand the principle of network architecture and protocol stack.
- study about the characteristics and functions of the individual layers of the protocol stack
- learn about the wired and wireless communication protocols used in industrial networks.

UNIT I RS – 232 AND RS – 485 **9**

ISO-OSI model – EIA 232 Interface standard – EIA 422 interface standard – 20mA current loop – Serial interface converters.

UNIT II MODBUS DATA HIGHWAY (PLUS) AND HART PROTOCOLS **9**

MODBUS protocol structure – Function codes – Troubleshooting – Data highway (plus) protocols – Review of HART Protocol.

UNIT III AS – INTREFACE AND DEVICENET **9**

AS interfaces:- Introduction, Physical layer, Data link layer and Operating characteristics. Devicenet:- Introduction, Physical layer, Data link layer and Application layer.

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

Profibus:- Introduction, Profibus protocol stack, Profibus communication model, Communication objects, System operations and Troubleshooting – Foundation fieldbus versus Profibus.

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION **9**

Industrial Ethernet:- Introduction, 10Mbps Ethernet and 100Mbps Ethernet – Radio and wireless communication:- Introduction, Components of radio link, radio spectrum and frequency allocation and radio modems – Comparison of various industrial networks.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Gain knowledge on the serial interface standards, network architecture and protocol stack
- Get familiarized with the wired and wireless communication protocols used in industrial networks.

TEXT BOOKS:

1. Mackay, S., Wrijut, E., Reynders, D. and Park, J., “practical Industrial Data Networks Design, installation and Troubleshooting”, Newnes Publications, Elsevier, 1st Edition, 2004.
2. Buchanan, W., “Computer Buses”, CRC Press, 2000,

REFRENCES:

1. Tanenbaum, A.S., “Modern Operating Systems”, Prentice Hall of India Pvt.Ltd.,2003.

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2. Rappaport,T.S., “Wireless Communication: principles and Practice” 2nd Edition, Prentice Hall of India, 2001

3. Stallings,W., “wireless Communication and networks”, 2nd Edition, Prentice Hall of India, 2005

GE8072 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.

GE8073 **HUMAN RIGHTS** **LT P C**
3 0 0 3

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

OUTCOMES :

- 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.

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