AFFILIATED INSTITUTIONS
B.E. INSTRUMENTATION AND CONTROL ENGINEERING
R - 2013

PROGRAM EDUCATIONAL OBJECTIVES:

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

PROGRAM OUTCOMES:

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

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## ANNA UNIVERSITY, CHENNAI
### AFFILIATED INSTITUTIONS
#### R - 2013
### B. E. INSTRUMENTATION AND CONTROL ENGINEERING
#### I TO VIII SEMESTERS CURRICULUM AND SYLLABUS

### SEMESTER I

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# Semester VIII

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**TOTAL CREDITS: 191**
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OBJECTIVES:
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize especially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

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

UNIT II
9+3
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Reading and interpreting visual material; Writing - Jumbled sentences - Essay writing - Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

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

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

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

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

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

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

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

EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

• Project
• Assignment
• Reviews
• Creative writing
• Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

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

End Semester Examination: 80%

MA6151 MATHEMATICS – I

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

UNIT II SEQUENCES AND SERIES 9+3

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

UNIT IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

UNIT V MULTIPLE INTEGRALS 9+3

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

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

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

UNIT II  PROPERTIES OF MATTER AND THERMAL PHYSICS  9
Elasticity- Hooke’s law - Relationship between three moduli of elasticity (qualitative) – stress - strain diagram – Poisson’s ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young’s modulus by uniform bending- I-shaped girders


UNIT III  QUANTUM PHYSICS  9

UNIT IV  ACOUSTICS AND ULTRASONICS  9

Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V  PHOTONICS AND FIBRE OPTICS  9

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

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

REFERENCES:

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

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

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

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

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY
UNIT IV PHASE RULE AND ALLOYS

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

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

TEXT BOOKS:

REFERENCES:

GE6151 COMPUTER PROGRAMMING
L T P C
3 0 0 3

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


UNIT II C PROGRAMMING BASICS


UNIT III ARRAYS AND STRINGS


UNIT IV FUNCTIONS AND POINTERS


UNIT V STRUCTURES AND UNIONS

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:


REFERENCES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) 1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I  PLANE CURVES AND FREE HAND SKETCHING 5+9

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES 5+9
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS 5+9
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+9
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only) 3
Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS
OUTCOMES:
On Completion of the course the student will be able to
• perform free hand sketching of basic geometrical constructions and multiple views of objects.
• do orthographic projection of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• prepare isometric and perspective sections of simple solids.
• demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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

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

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.
OBJECTIVES:
- To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I CIVIL ENGINEERING PRACTICE

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

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
   Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

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

II MECHANICAL ENGINEERING PRACTICE

Welding:
(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

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

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example –
Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

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

TOTAL: 45 PERIODS

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

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

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

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

# ELECTRICAL

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

# ELECTRONICS

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

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**GE6163 PHYSICS AND CHEMISTRY LABORATORY – I**

**PHYSICS LABORATORY – I**

**OBJECTIVES:**

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

**LIST OF EXPERIMENTS**

(Any FIVE Experiments)

1. (a) Determination of Wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

CHEMISTRY LABORATORY- I

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

LIST OF EXPERIMENTS
(Any FIVE Experiments)

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

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

REFERENCES:
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

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

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

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

UNIT III
9+3
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the
preparation of minutes - Writing summary after reading articles from journals - Format for journal articles - elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials - Attending a meeting and writing minutes.

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

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

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

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

TEXTBOOKS:

REFERENCES:

**EXTENSIVE Reading (Not for Examination)**

**Websites**
2. http://owl.english.purdue.edu

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

**EVALUATION PATTERN:**

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

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual presentations, Group discussions
- Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
- Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

**End Semester Examination: 80%**
OBJECTIVES:
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

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

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

UNIT III  LAPLACE TRANSFORM  9+3

UNIT IV  ANALYTIC FUNCTIONS  9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+k, kz, 1/z, z², e^z and bilinear transformation.

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

TOTAL (L:45+T:15): 60 PERIODS
OUTCOMES:
- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

REFERENCES:

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

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

UNIT I CONDUCTING MATERIALS

UNIT II SEMICONDUCTING MATERIALS

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS
Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

UNIT V ADVANCED ENGINEERING MATERIALS

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CY6251 ENGINEERING CHEMISTRY - II

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

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

UNIT II ELECTROCHEMISTRY AND CORROSION 9

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

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

UNIT V FUELS AND COMBUSTION 9

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES

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

A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III  POWER PLANT ENGINEERING  10

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

UNIT V  REFRIGERATION AND AIR CONDITIONING SYSTEM  10

TOTAL: 30 PERIODS

OUTCOMES:

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

REFERENCES:

EE6201 CIRCUIT THEORY L T P C
3 1 0 4

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

UNIT I BASIC CIRCUITS ANALYSIS 12

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

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

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

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

TOTAL : 60 PERIODS
OUTCOMES:
- Ability analyse electrical circuits
- Ability to apply circuit theorems
- Ability to analyse AC and DC Circuits

TEXT BOOKS:

REFERENCES:

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

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

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

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)
CHEMISTRY LABORATORY - II

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

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl$_2$ and Na$_2$SO$_4$

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

REFERENCES:

- Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)
OBJECTIVES:
The Students should be made to
- Be exposed to Unix shell commands
- Be familiar with an editor on Unix
- Learn to program in Shell script
- Learn to write C programme for Unix platform

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15
   Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15
   Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15
   Dynamic Storage Allocation-Pointers-Functions-File Handling
   TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the students should be able to:
- Use Shell commands
- Design of Implement Unix shell scripts
- Write and execute C programs on Unix

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

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

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

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

LIST OF EXPERIMENTS

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

TOTAL: 45 PERIODS

OUTCOMES:

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

2. Function Generator (1 MHz) - 10 Nos.
4. Oscilloscope (20 MHz) - 10 Nos.
5. Digital Storage Oscilloscope (20 MHz) – 1 No.
6. Circuit Simulation Software (5 Users) (Pspice / Matlab /other Equivalent software Package) with PC(5 Nos.) and Printer (1 No.)
7. AC/DC - Voltmeters (10 Nos.), Ammeters (10 Nos.) and Multi-meters (10 Nos.)
9. Decade Resistance Box, Decade Inductance Box, Decade Capacitance Box Each - 6 Nos.
10. Circuit Connection Boards - 10 Nos.

Necessary Quantities of Resistors, Inductors, Capacitors of various capacities (Quarter Watt to 10 Watt)
OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

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

UNIT II  FOURIER SERIES  9+3

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

UNIT IV  FOURIER TRANSFORMS  9+3

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

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

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

TEXT BOOKS:
REFERENCES:

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING

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

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

UNIT II ENVIRONMENTAL POLLUTION
Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry-Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NOx, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water
quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

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

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

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

OBJECTIVES:

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

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code0- Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families-operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS

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

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS

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

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.
UNIT V VHDL


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

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:


EC6202 ELECTRONIC DEVICES AND CIRCUITS

OBJECTIVES:

The student should be made to:

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

UNIT I PN JUNCTION DEVICES

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

UNIT II TRANSISTORS

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

UNIT III AMPLIFIERS

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.
UNIT IV  MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER  9
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers – Types (Qualitative analysis).

UNIT V  FEEDBACK AMPLIFIERS AND OSCILLATORS  9

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

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

TEXT BOOKS:

REFERENCES:

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

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

UNIT I  IC FABRICATION  9
IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT II  CHARACTERISTICS OF OPAMP  9
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – Inverting and Non-inverting Amplifiers-V/I & I/V converters, summer, differentiator and integrator.
UNIT III  APPLICATIONS OF OPAMP

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

UNIT IV  SPECIAL ICs

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

UNIT V  APPLICATION ICs

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

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:


EI6301  ELECTRICAL MEASUREMENTS  L T P C

3 1 0 4

OBJECTIVES:

• To introduce the meters used to measure current & voltage.
• To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
• To provide Elaborate discussion about potentiometer & instrument transformers.
• To provide Detailed study of resistance measuring methods.
• To provide Detailed study of inductance and capacitance measurement.

UNIT I  MEASUREMENT OF VOLTAGE AND CURRENT

UNIT II  MEASUREMENT OF POWER AND ENERGY  

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

UNIT IV  RESISTANCE MEASUREMENT  

UNIT V  IMPEDANCE MEASUREMENT  

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

TEXT BOOKS:

REFERENCES:
EC6361  ELECTRONICS LABORATORY  

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

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

TOTAL : 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC
4. Function Generators
5. Regulated 3 output Power Supply 5, ± 15V
6. CRO
7. Storage Oscilloscope
8. Bread boards
9. At least one demo module each for the listed equipments.
10. Component data sheets to be provided
OBJECTIVES:
Working Practice in simulators / CAD Tools / Experiment test bench to learn design, testing and characterizing of circuit behaviour with digital and analog ICs.

LIST OF EXPERIMENTS:
1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC’s and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC’s.
7. Study of multiplexer and demultiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
10. Study of VCO and PLL ICs:
    i. Voltage to frequency characteristics of NE/ SE 566 IC.
    ii. Frequency multiplication using NE/SE 565 PLL IC.

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

TOTAL : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
(3 per Batch)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the equipments / Components</th>
<th>Quantity Required</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>1</td>
<td>Dual ,(0-30V) variable Power Supply</td>
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<tr>
<td>2</td>
<td>CRO</td>
<td>9</td>
<td>30MHz</td>
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<td>3</td>
<td>Digital Multimeter</td>
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<tr>
<td>4</td>
<td>Function Generator</td>
<td>8</td>
<td>1 MHz</td>
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<td>5</td>
<td>IC Tester (Analog)</td>
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<tr>
<td>6</td>
<td>Bread board</td>
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</tr>
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<td></td>
<td>Description</td>
<td>Quantity</td>
<td></td>
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<tr>
<td>---</td>
<td>---------------------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Computer (PSPICE installed)</td>
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<td></td>
</tr>
</tbody>
</table>

**Consumables (Minimum of 25 Nos. each)**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IC 741/ IC NE555/566/565</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Digital IC types</td>
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<tr>
<td>3</td>
<td>LED</td>
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<tr>
<td>4</td>
<td>LM317</td>
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<td>5</td>
<td>LM723</td>
<td>25</td>
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<tr>
<td>6</td>
<td>ICGSG3524 / SG3525</td>
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<td>7</td>
<td>Transistor – 2N3391</td>
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<td>8</td>
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<td>9</td>
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<tr>
<td>10</td>
<td>Potentiometer</td>
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<tr>
<td>11</td>
<td>Step-down transformer</td>
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<tr>
<td>12</td>
<td>Capacitor</td>
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<td>13</td>
<td>Resistors 1/4 Watt Assorted</td>
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<tr>
<td>14</td>
<td>Single Strand Wire</td>
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</tr>
</tbody>
</table>

**MA6459  NUMERICAL METHODS  L T P C**

**3 1 0 4**

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

**UNIT I  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  10+3**

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

**UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  9+3**
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson’s 1/3 rule – Romberg’s method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson’s 1/3 rules.
UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

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.

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

TEXT BOOKS:

REFERENCES:

EI6401 TRANSDUCER ENGINEERING L T P C 3 0 0 3

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

UNIT I SCIENCE OF MEASUREMENTS AND CLASSIFICATION OF TRANSDUCERS 9
UNIT II CHARACTERISTICS OF TRANSDUCERS

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

OUTCOMES:
• Ability to model and analyze transducers.

TEXT BOOKS:

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

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

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

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

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

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I INTRODUCTION

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

UNIT II DISCRETE TIME SYSTEM ANALYSIS

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

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION


UNIT IV DESIGN OF DIGITAL FILTERS

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

UNIT V DIGITAL SIGNAL PROCESSORS


TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

REFERENCES:

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

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

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

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

UNIT III ADVANCED PROGRAMMING

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

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

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

TEXT BOOKS:

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

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

UNIT I  LAWS OF THERMODYNAMICS AND BASIC IC ENGINE CYCLES
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
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

UNIT IV  DIMENSIONAL AND MODEL ANALYSIS

UNIT V  PUMPS AND TURBINES

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

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

TEXT BOOKS:
REFERENCES:

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

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

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

TOTAL: 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. DC Shunt Motor with Loading Arrangement – 3 nos
2. Single Phase Transformer – 4 nos
3. DC Series Motor with Loading Arrangement – 1 No.
4. Three Phase Induction Motor with Loading Arrangement – 2 nos
5. Single Phase Induction Motor with Loading Arrangement – 1 No.
6. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
7. DC Shunt Motor Coupled With DC Shunt Generator – 1 No.
8. Tachometer -Digital/Analog – 8 nos
9. Single Phase Auto Transformer – 2 nos
10. Three Phase Auto Transformer – 1 No.
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank. – 2 nos
13. SPST switch – 2 nos

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

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

LIST OF EXPERIMENTS:
C++:
1. program using functions
   • functions with default arguments
   • implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
   • classes with primitive data members,
   • classes with arrays as data members
   • classes with pointers as data members
   • classes with constant data members
   • classes with static member functions
3. compile time polymorphism
   • operator overloading
   • function overloading
4. run time polymorphism
   • inheritance
   • virtual functions
   • virtual base classes
   • templates
5. file handling
   • sequential access
   • random access

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

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

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C++ compiler 30 Nos.

(or)

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

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**EE6502 MICROPROCESSORS AND MICROCONTROLLERS**

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

**UNIT I 8085 PROCESSOR**


**UNIT II PROGRAMMING OF 8085 PROCESSOR**

Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.
UNIT III  8051 MICRO CONTROLLER  9


UNIT IV  PERIPHERAL INTERFACING  9

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

UNIT V  MICRO CONTROLLER PROGRAMMING & APPLICATIONS  9


TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:

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

UNIT I SYSTEMS AND THEIR REPRESENTATION

UNIT II TIME RESPONSE

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

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

UNIT V STATE VARIABLE ANALYSIS

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

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  COLORIMETRY AND SPECTROPHOTOMETRY

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

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

UNIT III  INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS

Types of gas analyzers – Oxygen, NO₂ and H₂S 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

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective
ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer –
Silicon analyzer.

UNIT V  NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES

NMR :- Basic principles , NMR spectrometer and Applications - Electron spin Resonance
spectroscopy: – Basic principles, Instrumentation and applications. Scanning Electron Microscope
(SEM) :- Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM)

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

EI6502

INDUSTRIAL INSTRUMENTATION – I

L T P C
3 0 0 3

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

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

UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY
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

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

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


TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:

OBJECTIVES:

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

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

UNIT II  PHASE-CONTROLLED CONVERTERS
2-pulse,3-pulse and 6-pulse converters- performance parameters —Effect of source inductance — Gate Circuit Schemes for Phase Control—Dual converters.

UNIT III  DC TO DC CONVERTER

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

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

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:

REFERENCES:

EE6612 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

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

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   (i) Ascending / Descending order, Maximum / Minimum of numbers
   (ii) Programs using Rotate instructions
   (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
   (i) A/D Interfacing & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key, interface display
8. Demonstration of basic instructions with 8051 Microcontroller execution, including:
   (i) Conditional jumps, looping
   (ii) Calling subroutines.
9. Programming I/O Port 8051
   (i) study on interface with A/D & D/A
   (ii) study on interface with DC & AC motor.
10. Mini project development with processors.

TOTAL: 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

EI6511 TRANSUDCERS AND MEASUREMENTS LABORATORY  LT PC
0 0 3 2

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

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

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

TOTAL: 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

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

UNIT I  LISTENING AND SPEAKING SKILLS  12
Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.
UNIT II READING AND WRITING SKILLS
Reading different genres of tests ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries-interpreting visual texts.

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

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

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

TOTAL: 60 PERIODS

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

Lab Infrastructure:

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

**Evaluation:**

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

**External: 80 marks**
- Online Test - 35 marks
- Interview - 15 marks
- Presentation - 15 marks
- Group Discussion - 15 marks

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

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

**REFERENCES:**
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
4. Interactive Multimedia Programs on Managing Time and Stress.

**Web Sources:**
- [presentation-on-group-discussion](http://www.slideshare.net/rohitjsh)
- [present_tips.html](http://www.washington.edu/doit/TeamN)
- [writing-job-applications](http://www.oxforddictionaries.com/words)
- [coveringletters.htm](http://www.kent.ac.uk/careers)
- [newCDV_34.htm](http://www.mindtools.com/pages/article/newCDV_34.htm)
OBJECTIVES:
- To introduce different types of electronic voltmeters and their applications.
- To provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
- To introduce different types of waveform generators and analyzers and their applications.
- To educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
- To give exposure to telemetry, modulation techniques and multiplexing.

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

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

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

UNIT IV  VIRTUAL INSTRUMENTATION  
Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual instrumentation - VI programming techniques – DAQ cards for VI applications – DAQ modules with serial communication

UNIT V  TELEMETRY  

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
EI6602  PROCESS CONTROL  L T P C

3 1 0 4

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

UNIT I  PROCESS DYNAMICS

UNIT II  CONTROL ACTIONS

UNIT III  FINAL CONTROL ELEMENTS
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

UNIT V  MULTILOOP CONTROL

TOTAL (L:45+T:15): 60 PERIODS
OUTCOMES:
- Ability to understand and analyse process control engineering problems.

TEXT BOOKS:

REFERENCES:

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

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

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

UNIT II  QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS

UNIT III  ELECTRICAL TYPE FLOW METERS
UNIT IV LEVEL MEASUREMENT

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

UNIT V MEASUREMENT OF VISCOSITY, HUMIDITY AND MOISTURE


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

TEXT BOOKS:

REFERENCES:

IC6601 ADVANCED CONTROL SYSTEM

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

UNIT I STATE VARIABLE DESIGN

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

UNIT III DESCRIBING FUNCTION ANALYSIS

UNIT IV OPTIMAL CONTROL
Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti’s equation – Application examples.

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

EC6651 COMMUNICATION ENGINEERING
OBJECTIVES:
• To introduce different methods of analog communication and their significance
• To introduce Digital Communication methods for high bit rate transmission
• To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
• To introduce MAC used in communication systems for enhancing the number of users.
• To introduce various media for digital communication

UNIT I ANALOG COMMUNICATION
AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations
UNIT II DIGITAL COMMUNICATION
Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding: DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only)

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

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

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

TEXT BOOKS:

REFERENCES:

EI6611 INDUSTRIAL INSTRUMENTATION LABORATORY

OBJECTIVES:
The aim of this lab is to impart an adequate knowledge and expertise to handle equipment generally available in an industry.

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

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

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

TOTAL : 45 PERIODS 

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: 

<table>
<thead>
<tr>
<th>Expt. No.</th>
<th>List of equipments</th>
<th>Quantity required for a batch of 30 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Orifice plate</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Dead weight tester with pressure gauge</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Torque trainer</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Saybolt Viscometer</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Vacuum gauge</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>DP transmitter</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>UV – Visible spectrophotometer</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>IR spectrophotometer</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>pH meter</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Conductivity meter</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>ECG trainer</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>Pulse rate trainer</td>
<td>1</td>
</tr>
</tbody>
</table>
OBJECTIVES:
To experimentally verify the process control concepts on the selected process control loops.

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

TOTAL: 45 PERIODS

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

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

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

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

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

AIM
To determine the flow – lift characteristics (Internet / Installed) of a control valve equipped with and without valve positioner.
EXERCISE
1. Plot the flow – lift characteristics of the given valve without positioner keeping
   (i) Constant ΔP
   (ii) Variable ΔP
2. Compute the valve gain at different operating points.
3. Plot the flow – lift characteristics of the given with positioner keeping.
   i. Constant ΔP
   ii. Variable ΔP
4. Compute the valve gain at different operating points.

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

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

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

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

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

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

AIM
To obtain the ON/OFF response of temperature unit

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

EQUIPMENT
1. Temperature process station with all accessories

5. PID implementation issues.

   Equipment:
   Personal computer
   MATLAB software

6. Tuning of PID controller for mathematically described processes.
AIM
To study of various controller tuning

Equipment:
Personal computer
MATLAB software

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

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

EXERCISE
1. The secondary and primary controllers are tuned using any one of the tuning techniques.
2. Obtain the closed loop response of cascade control system with the load variable entering the inner loop.
3. Obtain the closed loop regulating response with conventional control system.
4. Compare the performance of conventional control system and cascade control system internal of peak overshoot, setting time, I&E etc

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

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

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

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

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

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

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

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

10. Study of AC and DC drives.

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

EXERCISE
1. Closed loop control of AC and DC motor.

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

11. Study of pH control test rig.

AIM
To determine the closed loop performance of a nonlinear system

EXERCISE
1. Open loop Characteristics study
2. Closed loop response

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


AIM
To study of various controller tuning

EQUIPMENT:
Personal computer
MATLAB software
OBJECTIVES:
- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering/technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

OUTCOMES:
- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

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

UNIT I INTRODUCTION

UNIT II PULSE TRANSFER FUNCTION AND TIME RESPONSE

UNIT III STABILITY
UNIT IV  DIGITAL PID CONTROLLER  9

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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

OBJECTIVES:
• To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
• To give adequate knowledge about applications of PLC
• To give basic knowledge about Computer Controlled Systems
• To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
• To give adequate information with respect to interfaces used in DCS

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

UNIT II  APPLICATIONS OF PLC  9
Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions – Case studies in PLC
UNIT III  COMPUTER CONTROLLED SYSTEMS  
Basic building blocks of computer controlled systems – Data acquisition system – Supervisory control 
– Direct digital control- SCADA:- Hardware and software, Remote terminal units, Master 
Station and Communication architectures.

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:
   Reinhold Co., 1986  
3. D. Popovic and V.P.Bhatkar,’ Distributed computer control for industrial Automation’ Marcel 

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.
   of India, New Delhi, 2010.
4.  John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers, Pearson, 
   New Delhi, 2004.
EI6701 INDUSTRIAL DATA NETWORKS

L T P C 3 0 0 3

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

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

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

UNIT III HART AND FIELDBUS

UNIT IV MODBUS AND PROFIBUS PA/DP/FMS AND FF
MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation fieldbus - Data Highway

UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION
Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.

TOTAL :45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems.
- To provide comprehensive knowledge of fuzzy logic control to real-time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

UNIT I ARCHITECTURES – ANN


UNIT II NEURAL NETWORKS FOR CONTROL


UNIT III FUZZY SYSTEMS


UNIT IV APPLICATION OF FUZZY LOGIC SYSTEMS

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

UNIT V GENETIC ALGORITHMS


OUTCOMES:

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

TEXT BOOKS:


REFERENCES:

EI6704  BIOMEDICAL INSTRUMENTATION  L T P C
3 0 0 3

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

UNIT I  FUNDAMENTALS OF BIOMEDICAL ENGINEERING


UNIT II  NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES


UNIT III  ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS


UNIT IV  IMAGING MODALITIES AND ANALYSIS


UNIT V  LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES


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

TEXT BOOKS:

REFERENCES:

IC6711 ADVANCED CONTROL SYSTEM LABORATORY

OBJECTIVES:
To provide training on process simulation and design of advanced controllers.

LIST OF EXPERIMENTS:
1. Simulation of first order and second order system with and without dead time using discretization method and Runge – Kutta method
2. Design of Discrete P+I+D controller and Deadbeat controller for a first order system
4. State estimation of a process using full order and reduced order observers.
5. Logic gates operations, Timing Operations, counter operations and math operations using PLC.
6. Control of Bottle filling system and sequential operation of motors using PLC.
7. PC based data acquisition report generation.
8. Simulation of complex control systems using matlab/other equivalent software package.
9. Study of distributed control system.
10. Control of a given process using Real Time Embedded controller

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. PC - 20 nos
2. PLC unit - 3 nos
3. Bottle Filling System - 2 nos
4. DAQ Card - 2 nos
5. MatLab/other equivalent software (Original Version) - 2 nos
6. DCS - 2 nos
7. Any Real Time OS

EI6711     INSTRUMENTATION SYSTEM DESIGN LABORATORY     L T P C

0 0 3 2

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

LIST OF EXPERIMENTS:

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

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

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

IC6712              COMPREHENSION               L T P C
                                               0 0 2 1

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

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

TOTAL : 30 PERIODS

OUTCOMES:
- Ability to review, prepare and present technological developments
OBJECTIVES:
- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

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

UNIT I  DISCRETE STATE-VARIABLE TECHNIQUE

UNIT II  SYSTEM IDENTIFICATION

UNIT III  DIGITAL CONTROLLER DESIGN

UNIT IV  MULTI-LOOP REGULATORY CONTROL

UNIT V  MULTIVARIABLE REGULATORY CONTROL

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

TEXT BOOKS:

REFERENCES:

**IC6811 PROJECT WORK**

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

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

**TOTAL: 180 PERIODS**

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

**CS6659 ARTIFICIAL INTELLIGENCE**

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

**UNIT I INTRODUCTION TO AI AND PRODUCTION SYSTEMS**
- Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.
UNIT II REPRESENTATION OF KNOWLEDGE

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

UNIT III KNOWLEDGE INFERENCE

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

UNIT IV PLANNING AND MACHINE LEARNING


UNIT V EXPERT SYSTEMS


OUTCOMES:

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

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

TEXT BOOKS:


REFERENCES:

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

UNIT I  OVERVIEW & INSTRUCTIONS  9

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

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

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

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

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

TEXT BOOK:

REFERENCES:

CS6401 OPERATING SYSTEMS L T P C 3 0 0 3

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

UNIT I OPERATING SYSTEMS OVERVIEW

UNIT II PROCESS MANAGEMENT

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

UNIT IV I/O SYSTEMS

UNIT V CASE STUDY
Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen, VMware on Linux Host and Adding Guest OS.
OUTCOMES:
At the end of the course, the student should be able to:
- Design various Scheduling algorithms
- Apply the principles of concurrency
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes
- Design and Implement a prototype file systems
- Perform administrative tasks on Linux Servers

TEXT BOOK:

REFERENCES:
5. http://nptel.ac.in/

EI6001 DATA STRUCTURES AND ALGORITHMS

OBJECTIVES:
- To provide a good understanding of the fundamental data structures used in computer science
- To provide a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To educate on the space and time efficiency of most algorithms
- To educate on design of new algorithms or modify existing ones for new applications
- To introduce graph algorithms

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

UNIT II ADVANCED DATA STRUCTURES

UNIT III SORTING AND HASHING
UNIT IV ALGORITHM DESIGN TECHNIQUES
The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer-dynamic programming-Greedy Algorithm – Backtracking.

UNIT V GRAPHS ALGORITHMS

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

TEXT BOOKS:

REFERENCES:

EI6002 POWER PLANT INSTRUMENTATION

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

UNIT I OVERVIEW OF POWER GENERATION

UNIT II MEASUREMENTS IN POWER PLANTS
UNIT III  BOILER CONTROL – I  9

UNIT IV  BOILER CONTROL – II  9

UNIT V  CONTROL OF TURBINE  9
Types of steam turbines – impulse and reaction turbines – compounding – Turbine governing system – Speed and Load control – Transient speed rise – Free governor mode operation – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system – Turbine run up system.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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

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

UNIT I  OIL EXTRACTION AND PROCESSING  9
Techniques used for oil discovery - seismic survey - methods of oil extraction - oil rig system - Primary and Secondary recovery - Enhanced oil recovery - separation of gas and water from oil - control loops in oil gas separator - scrubber - coalescer
UNIT II    PETROLEUM REFINING
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
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
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
Area and material classification as per National Electric Code (NEC) - Classification as per International Electro technical Commission (IEC) - Techniques used to reduce explosion hazards - Pressurization techniques - Type X, Type Y and Type Z - Intrinsic safety - Mechanical and Electrical isolation - Lower and Upper explosion limit

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
EE6602 EMBEDDED SYSTEMS  LT P C  3 0 0 3

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

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS  9

UNIT II EMBEDDED NETWORKING  9

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT  9
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN  9
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, чC/OS-II, RT Linux.

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

UNIT I DIGITAL IMAGE FUNDAMENTALS 8

UNIT II IMAGE ENHANCEMENT 10

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

TOTAL: 45 PERIODS

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

TEXT BOOK:

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

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

UNIT II      ADVANCES IN LPP
Dualit theory- Dual simplex method - Sensitivity analysis—Transportation problems— Assignment problems-Traveling sales man problem -Data Envelopment Analysis

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

UNIT IV      INTERIOR POINT METHODS

UNIT V      DYNAMIC PROGRAMMING

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
   New Delhi, 2005.

IC6001 OPTIMAL CONTROL

OBJECTIVES:
- To give exposure to optimal control problems such as time-optimal, fuel optimal, energy optimal control problems
- To impart knowledge and skills needed to design Linear Quadratic Regulator for Time invariant and Time-varying Linear system (Continuous time and Discrete-time systems)
- To introduce concepts needed to design optimal controller using Dynamic Programming Approach and H-J-B equation.
- To give exposure to various types of fault tolerant control schemes such as Passive and active approaches
- To introduce concepts needed to design optimal controller in the presence of state constraints and time optimal controller

UNIT I  CALCULUS OF VARIATIONS AND OPTIMAL CONTROL


UNIT II  LINEAR QUADRATIC OPTIMAL CONTROL SYSTEM

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

UNIT III  DISCRETE TIME OPTIMAL CONTROL SYSTEMS

Variational calculus for Discrete time systems – Discrete time optimal control systems: Fixed final state and open-loop optimal control and Free-final state and open-loop optimal control - Discrete time linear state regulator system – Steady state regulator system

UNIT IV  Pontryagin Minimum Principle


UNIT V  CONSTRAINED OPTIMAL CONTROL SYSTEMS


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

TEXT BOOKS:

REFERENCES:

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

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

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

UNIT II PARAMETER ESTIMATION METHODS

UNIT III RECURSIVE IDENTIFICATION METHODS

UNIT IV ADAPTIVE CONTROL SCHEMES
UNIT V    ISSUES IN ADAPTIVE CONTROL AND APPLICATIONS

Stability – Convergence – Robustness – Applications of adaptive control.

OUTCOMES:

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

TEXT BOOKS:


REFERENCES:


EE6008    MICROCONTROLLER BASED SYSTEM DESIGN

OBJECTIVES:

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

UNIT I    INTRODUCTION TO PIC MICROCONTROLLER


UNIT II    INTERRUPTS AND TIMER


UNIT III    PERIPHERALS AND INTERFACING


UNIT IV    INTRODUCTION TO ARM PROCESSOR

UNIT V ARM ORGANIZATION


TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCE:

EE 6007 MICRO ELECTRO MECHANICAL SYSTEMS

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

UNIT I INTRODUCTION

UNIT II SENSORS AND ACTUATORS-I

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

UNIT V  POLYMER AND OPTICAL MEMS  9
Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene –
Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS –
Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

OUTCOMES:

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

TEXT BOOKS:
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill,
   New Delhi, 2002.

REFERENCES:
   Smart Devices, John Wiley & Son LTD, 2002.

GE6081  FUNDAMENTALS OF NANOSCIENCE  3 0 0 3

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

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

102
UNIT II  GENERAL METHODS OF PREPARATION

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

UNIT III  NANOMATERIALS

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionailization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV  CHARACTERIZATION TECHNIQUES

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

UNIT V  APPLICATIONS


TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES
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 Processes 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, Scenarios in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE6757 TOTAL QUALITY MANAGEMENT

OBJECTIVES:

- To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II
UNIT V  QUALITY SYSTEMS

TOTAL: 45 PERIODS

OUTCOMES:
• The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:

GE6075  PROFESSIONAL ETHICS IN ENGINEERING  LT P C 3 0 0 3
OBJECTIVES:
• To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V   GLOBAL ISSUES  

OUTCOMES:
- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

REFERENCES:

Web sources:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

EC6002   ADVANCED DIGITAL SIGNAL PROCESSING  
L T P C
3 0 0 3

OBJECTIVES:
- To bring out the concepts related to stationary and non-stationary random signals
- To emphasize the importance of true estimation of power spectral density
- To introduce the design of linear and adaptive systems for filtering and linear prediction
- To introduce the concept of wavelet transforms in the context of image processing

UNIT I   DISCRETE-TIME RANDOM SIGNALS  
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

UNIT V        WAVELET TRANSFORM 9
Multiresolution analysis, Continuous and discrete wavelet transform, Short Time Fourier Transform, Application of wavelet transform, Cepstrum and Homomorphic filtering.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
• Explain the parametric methods for power spectrum estimation.
• Discuss adaptive filtering techniques using LMS algorithm and the applications of adaptive filtering.
• Analyze the wavelet transforms.

TEXT BOOKS:

REFERENCE:
freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints--Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9
Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

GE6084 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVES :
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I 9
UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

TOTAL : 45 PERIODS

OUTCOME :
• Engineering students will acquire the basic knowledge of human rights.

REFERENCES: