# Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

## Curriculum and Syllabus for

## B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

**SEMESTER I to VIII**

**with effect from 2014-15**

**REGULATIONS 2014**

DR MAHALINGAM

MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

| |
|---|
| **Programme : B.E. – Electronics and Instrumentation Engineering** |
| **Curriculum and Syllabus : Semesters – I to VIII** |
| **Approved by Academic Council** |

| Action | Responsibility | Signature of Authorized Signatory |
|---|---|---|
| Designed and Developed by | BoS Electronics and Instrumentation Engineering | |
| Compiled by | Office of the Controller of Examinations | |
| Approved by | Principal | |

## DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

### Regulations 2014 - Revision 0

### Curriculum for B.E. Electronics and Instrumentation Engineering

### SEMESTER I

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 1 | 140CO0101 | Technical English | 2 | 0 | 2 | 3 | 100 |
| 2 | 140CO0102 | Engineering Mathematics – I | 3 | 1 | 0 | 4 | 100 |
| 3 | 140CO0103 | Engineering Physics | 3 | 0 | 0 | 3 | 100 |
| 4 | 140CO0104 | Engineering Chemistry | 3 | 0 | 0 | 3 | 100 |
| 5 | 140CO0105 | C Programming | 3 | 0 | 0 | 3 | 100 |
| 6 | 140EI0106 | Basics of Civil and Mechanical Engineering | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 7 | 140EI0107 | Engineering Practices Laboratory (Civil & Mechanical) | 0 | 0 | 3 | 2 | 100 |
| 8 | 140CO0108 | C Programming Laboratory | 0 | 0 | 3 | 2 | 100 |
| 9 | 140CO0210 | Engineering Physics and Chemistry Laboratory (Annual Pattern) | 0 | 0 | 3 | - | - |

**Total Credits : 23**

### SEMESTER II

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 10 | 140CO0201 | Communication Skills | 2 | 0 | 2 | 3 | 100 |
| 11 | 140CO0202 | Engineering Mathematics – II | 3 | 1 | 0 | 4 | 100 |
| 12 | 140CO0203 | Material Science | 3 | 0 | 0 | 3 | 100 |
| 13 | 140CO0204 | Environmental Science | 3 | 0 | 0 | 3 | 100 |
| 14 | 140EI0205 | Electrical Circuit Analysis | 3 | 1 | 0 | 4 | 100 |
| 15 | 140EI0206 | Electron Devices | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 16 | 140EI0207 | Engineering Practices Laboratory (Electrical, Electronics and PC hardware) | 0 | 0 | 3 | 2 | 100 |
| 17 | 140EI0208 | Circuits and Devices Laboratory | 0 | 0 | 3 | 2 | 100 |
| 18 | 140CO0209 | Engineering Graphics | 2 | 0 | 3 | 3 | 100 |
| 19 | 140CO0210 | Engineering Physics and Chemistry Laboratory (Annual Pattern) | 0 | 0 | 3 | 2 | 100 |

**Total Credits : 29**

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## SEMESTER III

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 20 | 140EI0301 | Engineering Mathematics – III | 3 | 1 | 0 | 4 | 100 |
| 21 | 140EI0302 | Thermal Engineering and Fluid Mechanics | 3 | 1 | 0 | 4 | 100 |
| 22 | 140EI0303 | Transducer Engineering | 3 | 0 | 0 | 3 | 100 |
| 23 | 140EI0304 | Object Oriented Programming Concepts | 3 | 0 | 0 | 3 | 100 |
| 24 | 140EI0305 | Electronic Circuits | 3 | 0 | 0 | 3 | 100 |
| 25 | 140EI0306 | Electrical Machines and Measurements | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 26 | 140EI0307 | Thermal Engineering and Fluid Mechanics Laboratory | 0 | 0 | 3 | 2 | 100 |
| 27 | 140EI0308 | Electrical Machines and Measurements Laboratory | 0 | 0 | 3 | 2 | 100 |
| 28 | 140EI0309 | Electronic Circuits Laboratory | 0 | 0 | 3 | 2 | 100 |
| 29 | | One Credit Course | 0 | 0 | 3 | 1 | 100 |

**Total Credits : 27**

## SEMESTER IV

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 30 | 140EI0401 | Numerical Methods | 3 | 1 | 0 | 4 | 100 |
| 31 | 140EI0402 | Linear Integrated Circuits and Applications | 3 | 0 | 0 | 3 | 100 |
| 32 | 140EI0403 | Industrial Instrumentation-I | 3 | 0 | 0 | 3 | 100 |
| 33 | 140EI0404 | Communication Engineering | 3 | 0 | 0 | 3 | 100 |
| 34 | 140EI0405 | Digital Principles and Applications | 3 | 0 | 0 | 3 | 100 |
| 35 | 140EI0406 | Data Structures and Algorithms using C++ | 3 | 1 | 0 | 4 | 100 |
| **Practical** | | | | | | | |
| 36 | 140EI0407 | Integrated Circuits Laboratory | 0 | 0 | 3 | 2 | 100 |
| 37 | 140EI0408 | Transducer and Signal Conditioning Laboratory | 0 | 0 | 3 | 2 | 100 |
| 38 | 140EI0409 | Data structures and Algorithms and Object Oriented Programming Laboratory | 0 | 0 | 3 | 2 | 100 |
| 39 | | One Credit Course | 0 | 0 | 3 | 1 | 100 |

**Total Credits : 27**

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## SEMESTER V

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 40 | 140EI0501 | Control Engineering | 3 | 1 | 0 | 4 | 100 |
| 41 | 140EI0502 | Biomedical Engineering | 3 | 0 | 0 | 3 | 100 |
| 42 | 140EI0503 | Modern Electronic Instrumentation | 3 | 0 | 0 | 3 | 100 |
| 43 | 140EI0504 | Industrial Instrumentation - II | 3 | 0 | 0 | 3 | 100 |
| 44 | 140EI0505 | Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 | 100 |
| 45 | 140EI0506 | Power Electronics | 3 | 1 | 0 | 4 | 100 |
| **Practical** | | | | | | | |
| 46 | 140EI0507 | Microprocessors and Microcontrollers Laboratory | 0 | 0 | 3 | 2 | 100 |
| 47 | 140EI0508 | Industrial Instrumentation Laboratory | 0 | 0 | 3 | 2 | 100 |
| 48 | 140EI0509 | System Simulation and Virtual Instrumentation Laboratory | 0 | 0 | 3 | 2 | 100 |
| 49 | | One Credit Course | 0 | 0 | 3 | 1 | 100 |

**Total Credits : 27**

## SEMESTER VI

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 50 | 140EI0601 | Embedded System Design | 3 | 0 | 0 | 3 | 100 |
| 51 | 140EI0602 | Principles of Digital Signal Processing | 3 | 1 | 0 | 4 | 100 |
| 52 | 140EI0603 | Process Control | 3 | 0 | 0 | 3 | 100 |
| 53 | 140EI0604 | VLSI Design | 3 | 0 | 0 | 3 | 100 |
| 54 | XXX | Elective - I | 3 | 0 | 0 | 3 | 100 |
| 55 | XXX | Elective - II | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 56 | 140EI0607 | Process Control Laboratory | 0 | 0 | 3 | 2 | 100 |
| 57 | 140EI0608 | Digital Signal Processing Laboratory | 0 | 0 | 3 | 2 | 100 |
| 58 | 140EI0610 | Mini project | 0 | 0 | 3 | 2 | 100 |
| 59 | | One Credit Course | 0 | 0 | 3 | 1 | 100 |

**Total Credits : 26**

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## SEMESTER VII

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 60 | 140EI0701 | Principles of Management | 3 | 0 | 0 | 3 | 100 |
| 61 | 140EI0702 | Logic and Distributed Control System | 3 | 0 | 0 | 3 | 100 |
| 62 | 140EI0703 | Instrumentation System Design | 3 | 0 | 0 | 3 | 100 |
| 63 | xxx | Elective – III | 3 | 0 | 0 | 3 | 100 |
| 64 | xxx | Elective – IV | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 65 | 140EI0707 | Industrial Automation Laboratory | 0 | 0 | 3 | 2 | 100 |
| 66 | 140EI0708 | Embedded System Design Laboratory | 0 | 0 | 3 | 2 | 100 |
| | 140EI0810 | Project Work (Annual Pattern) | 0 | 0 | 3 | - | 100 |

**Total Credits : 19**

## SEMESTER VIII

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| **Theory** | | | | | | | |
| 67 | 140EI0801 | Engineering Economics and Financial Accounting | 3 | 0 | 0 | 3 | 100 |
| 68 | xxx | Elective – V | 3 | 0 | 0 | 3 | 100 |
| 69 | xxx | Elective – VI | 3 | 0 | 0 | 3 | 100 |
| **Practical** | | | | | | | |
| 70 | 140EI0810 | Project Work (Annual Pattern) | 0 | 0 | 12 | 8 | 200 |

**Total Credits : 17**

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## LIST OF ELECTIVES

| S.No | Course Code | Course Name | L | T | P | C | M |
|---|---|---|---|---|---|---|---|
| | | **ELECTRONICS STREAM** | | | | | |
| 1 | 140EI9111 | ASIC Design | 3 | 0 | 0 | 3 | 100 |
| 2 | 140EI9112 | Digital Image Processing | 3 | 0 | 0 | 3 | 100 |
| | | **INSTRUMENTATION STREAM** | | | | | |
| 3 | 140EI9113 | Analytical Instrumentation | 3 | 0 | 0 | 3 | 100 |
| 4 | 140EI9114 | Automobile and Aircraft Instrumentation | 3 | 0 | 0 | 3 | 100 |
| 5 | 140EI9115 | Fiber Optics and Laser Instruments | 3 | 0 | 0 | 3 | 100 |
| 6 | 140EI9116 | Instrumentation in Petrochemical Industries | 3 | 0 | 0 | 3 | 100 |
| 7 | 140EI9117 | Power Plant Instrumentation | 3 | 0 | 0 | 3 | 100 |
| 8 | 140EI9118 | Smart and Wireless Instrumentation | 3 | 0 | 0 | 3 | 100 |
| | | **CONTROL STREAM** | | | | | |
| 9 | 140EI9119 | Advanced Process Control | 3 | 0 | 0 | 3 | 100 |
| 10 | 140EI9120 | Digital Control and State Variable Methods | 3 | 1 | 0 | 4 | 100 |
| 11 | 140EI9121 | Neural Network and Fuzzy Logic Control | 3 | 0 | 0 | 3 | 100 |
| 12 | 140EI9122 | Instrumentation and Control in Paper Industries | 3 | 0 | 0 | 3 | 100 |
| 13 | 140EI9123 | Industrial Drives and Control | 3 | 0 | 0 | 3 | 100 |
| 14 | 140EI9124 | Non Linear Control System | 3 | 1 | 0 | 4 | 100 |
| | | **MECHANICAL STREAM** | | | | | |
| 15 | 140EI9125 | Micro Electro Mechanical Systems | 3 | 0 | 0 | 3 | 100 |
| 16 | 140EI9126 | Robotics and Automation | 3 | 0 | 0 | 3 | 100 |
| | | **NETWORK STREAM** | | | | | |
| 17 | 140EI9127 | Wireless Sensor Networks | 3 | 0 | 0 | 3 | 100 |
| 18 | 140EI9128 | Industrial Data Communication Networks | 3 | 0 | 0 | 3 | 100 |
| | | **GENERAL STREAM** | | | | | |
| 19 | 140EI9129 | Disaster Management | 3 | 0 | 0 | 3 | 100 |
| 20 | 140EI9130 | Professional Ethics and Human Values | 3 | 0 | 0 | 3 | 100 |

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## SEMESTER I

| | |
|---|---|
| **Course Code:** 140CO0101 | **Course Title: TECHNICAL ENGLISH** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 2 : 0: 2 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1.** Employ appropriate vocabulary in different academic and professional contexts.

**CO2.** Comprehend lectures and technical oriented passages.

**CO3.** Apply suitable reading strategies to any science texts.

**CO4.** Speak effectively in real life and work related situations

**CO5.** Write grammatically correct sentences.

**Course Content:**

**UNIT I FUNCTIONAL ENGLISH GRAMMAR 6+6**

Mechanical and grammatical structures of written English-Errors in writing mechanics -Errors in spelling-Usage and punctuation–Cohesion and Discourse-Sequencing of jumbled sentences using connectives-Embedded questions-Incorrect English (Indian Scenario)

**UNIT II LISTENING & SPEAKING - PHONETICS 6+6**

Sounds of language -Sounds-phonemes -Organs of speech-Articulation-Consonants-vowels-International Phonetic Alphabets (IPA)-Stress and Tones-Stress, pause & intonation-Transcription-Listening Comprehension.

**UNIT - III SPEAKING 6+6**

Language for social purpose – Conversation-Making Introductions -Inviting questions and responses-Expressing Opinions-Individual Presentation-Extempore-Telephonic conversation.

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**UNIT - IV GRAMMAR** **6+6**

Prepositions -Sentence Pattern-Concord –Tenses-Articles -Active & Passive Voice-Comparative adjectives-Nominal Compounds-Modal Verbs-Writing definitions -Expressions of use and purpose-Expressions for compare and contrast- Phrasal verbs.

**UNIT -V WRITING** **6+6**

Instructions –Recommendations -Sequencing of Sentences-Paragraph Writing-Transcoding data - Note Making.

**TEXT BOOKS:**


1. NiraKonar, "Communication Skills for Professionals", PHI Learning Private Limited, New Delhi, 2009.


**REFERENCE BOOKS:**


1. Peter Roach, "English Phonetics and Phonology", CambridgeUniversity Press, United Kingdom, 2004
2. Halliday.M.A.K, "An introduction to Functional English Grammar", Edward Arnold Publishers Ltd.U.S.A, 1985
3. Walter.E.Oliu, "Writing That Works- How to Write Effectively on the Job", St.Martin's Press, New York,1980
4. Raymond Murphy, "Murphy's English Grammar", Cambridge University Press, United Kingdom, 2004
5. Martin Hewings, "Advanced English Grammar", CambridgeUniversity Press, 1999


**WEB REFERENCE:**

1. http://www.englishpage.com/grammar/index.html
2. UsingEnglish.com
3. http://www.perfect-english-grammar.com/
4. http://esl.fis.edu/grammar

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| | |
|---|---|
| **Course Code:** 140CO0102 | **Course Title: ENGINEERING MATHEMATICS- I** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1: 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours: 60** |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1.** Use Eigen values and Eigen vectors of a real matrix to reduce quadratic form to canonical form.

**CO2.** Write equations of sphere and cylinder under various geometrical conditions.

**CO3.** Use differential calculus concepts to derive equations of evolutes of curves.

**CO4.** Apply partial derivatives to calculate maxima and minima for functions of several variables

**CO5.** Apply multiple integrals to find area of plane curves and volume of solids.

**Course Content:**

**UNIT I MATRICES** **9+3**

Rank of a matrix (Revision)-Solution of system of equations-Characteristic equations-Eigen values and Eigen vectors of a real matrix-Geometrical meaning-Significance- Diagonalization by orthogonal transformation-Quadratic forms and Canonical forms-Transformation of quadratic forms to canonical forms through orthogonal transformation.

**UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY** **9+3**

Direction cosines- Direction ratios-The plane and the straight line (Revision) - Sphere-Plane section of a sphere- Equation of a sphere through a circle-Tangent plane- Orthogonal spheres -Cylinder-Right circular cylinder.

**UNIT - III DIFFERENTIAL CALCULUS** **9+3**

Curvature in Cartesian and polar co-ordinates-Centre and radius of curvature-Circle of curvature-Evolutes of some standard curves (Parabola, Ellipse, Hyperbola, Astroid, Cycloid) – Envelopes.

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**UNIT - IV FUNCTIONS OF SEVERAL VARIABLES 9+3**

Partial derivatives (Revision)- Euler's theorem for homogenous functions-Total derivatives-Jacobians - Taylor's expansions- Maxima and minima for functions of two variables-Method of Lagrange's multipliers.

**UNIT -V MULTIPLE INTEGRALS 9+3**

Double integration-Cartesian and polar coordinates-Change of order of integration-Transformation from Cartesian to polar, spherical and cylindrical coordinates-Triple integration in Cartesian Coordinates-Applications: Evaluating area and volume using multiple integrals.

**TEXT BOOKS:**


1. Veerarajan.T, "Engineering Mathematics", Updated 2nd Edition, Tata McGraw Hill, New Delhi,2010.
2. Ramakrishna Prasad.A, " Kreyszig's Engineering Mathematics I " , 1st Edition,Wiley India Pvt. Ltd., India, 2011.


**REFERENCE BOOKS:**


1. Venkatraman.M.K, "Engineering Mathematics-Volume I", 4th edition, National publishing company, Chennai, 2008.
2. Kandasamy.P,Thilagavathy. K., Gunavathy. K.,"Engineering Mathematics", Revised 9th Edition,S. Chand and Company Ltd., New Delhi, 2011.
3. Grewal.B.S. "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
4. Louis.C.Barrett, Ray Wylie.C, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Publishing Company Ltd, New Delhi, 2003.


**WEB REFERENCE:**

1. http://nptel.ac.in/
2. http://ocw.mit.edu/courses/mathematics
3. http://mathworld.wolfram.com/**FourierSeries**.html

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| | |
|---|---|
| **Course Code:**140CO0103 | **Course Title: ENGINEERING PHYSICS**<br>(Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO 1** Explain the properties, production and detection of ultrasonic

**CO 2** Explain the working of laser and its applications

**CO 3** Explain the types of fibers, fabrication and its applications.

**CO 4** Explain the behavior of particle.

**CO 5** Calculate the miller indices and to know the crystal defects

**Course Content:**

**UNIT I ACOUSTICS AND ULTRASONICS 9**

Acoustics: Sound intensity – Decibel - Reverberation - Sabines' formula. Factors affecting acoustics of buildings and remedies, Noise pollution and control, Noise control in machines. Ultrasonics: Magnetostriction and Piezoelectric generators. Detection and Properties of Ultrasonics – Cavitation - Industrial applications: Drilling, welding, soldering and cleaning – NDT: Pulse echo system, through transmission, resonance system - A, B and C scan displays with respect to flaw detection.

**UNIT II LASERS 9**

Laser principles: Stimulated and spontaneous emissions of radiations - Population inversion and pumping methods – Properties of lasers - Nd: YAG laser - He-Ne gas laser - $CO_2$ molecular laserand semiconductor lasers – Applications of Lasers: welding, drilling, cutting and heat treatment of materials. Holography: construction, reconstruction and applications - Medical applications of lasers (qualitative).

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**UNIT - III FIBER OPTICS** **9**

Principle of light propagation in optical fibres - Numerical aperture and acceptance angle -Types of fibres: based on material, refractive index, and mode of propagation. Fabrication of fibre using double crucible technique, splicing - Light sources: LD & LED. Detectors: PN, PIN & Avalanche photo diodes. Fibre optical communication systems and its advantages - Fibre optic sensors: temperature and displacement - Endoscope.

**UNIT - IV QUANTUM PHYSICS** **9**

Schrodinger's wave equations : Time independent and time dependent - Physical significance of the wave function - Particle in a potential box - Electron microscopes: Scanning electron, transmission electron and Scanning transmission electron microscope.

**UNIT -V CRYSTAL STRUCTURE** **9**

Amorphous and Crystalline materials. Lattice - Unit cell - Bravais lattices. Crystal structures: SC, BCC, FCC and HCP – Calculation of number of atoms per unit cell, Coordination number, nearest neighbor distance, Atomic radius and packing factor - Diamond, NaCl structures. Miller indices – Interplanar distance Crystal defects: point, line and surface defects and their influence on the properties of materials (Qualitative).

**TEXT BOOKS:**


1. Avadhanulu.M.N and Kshirsagar.P.G, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2009.


**REFERENCE BOOKS:**


1. Palanisamy.P. K, "Engineering Physics", Scitech Publishers, Chennai, 2006.
2. Jayakumar.S, "Engineering Physics"', R.K. Publishers, Coimbatore, 2008.
3. Rajendran.V, "Engineering Physics", Tata McGraw-Hill Co, New Delhi, 2007.
4. Arthur Beiser, "Modern Physics", Tata McGraw-Hill Co, New Delhi, 2003


**WEB REFERENCE:**

1. http://www.physicsclassroom.com/
2. http://hyperphysics.phy-astr.gsu.edu/
3. http://www.tndte.com/TEXT%20BOOKS/Complete%20Books/Engineering%20Physics-I%20&%20II/Engineering%20Physics%20Sem%20-1%20&%202.pdf

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| | |
|---|---|
| **Course Code:** 140CO0104 | **Course Title: ENGINEERING CHEMISTRY** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1.** Explain the chemistry of water and specify the water treatment processes

**CO2.** Determine the rate of corrosion of a metal in a given environment and identify appropriate control techniques to avoid corrosion

**CO3.** Explain the application of adsorption in ion exchange and chromatography and principle of spectroscopic method of chemical analysis.

**CO4.** Describe the efficiency of fuels in different states based on its composition and calorific value.

**CO5.** Explain the basics of engineering materials and energy storing devices

**Course Content:**

**UNIT I WATER TREATMENT TECHNOLOGY 9**

Introduction- Impurities in water- Effect of impurities in natural waters-hardness –estimation of hardness by EDTA method (problems). Boiler feed water – disadvantages of using hard water in boilers.Internal conditioning (phosphate, calgon and carbonate conditioning methods), External conditioning – demineralization process – desalination (reverse osmosis). Domestic and waste water treatment.

**UNIT II CORROSION AND ITS CONTROL 9**

Chemical corrosion – Pilling - Bedworth rule – electrochemical corrosion –different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion, Corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors-protective coatings– metallic coatings – electroplating (Au) and electroless (Ni) plating. Paint- drying action of paint and its constituents.

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**UNIT - III** **SURFACE CHEMISTRY AND INSTRUMENTAL METHODS OF ANALYSIS** **9**

**Surface chemistry:** Adsorption- types – adsorption isotherm – Freundlich, Langmuir, application of adsorption technology in industries (ion exchange adsorption and adsorption chromatography).

**Instrumental methods of Analysis:** Beer –Lambert's Law –UV- VISIBLE, Flame Photometry, AAS, principle and Instrumentation (Block diagram only).

**UNIT - IV** **FUELS AND LUBRICANTS** **9**

Coal – classification – Calorific value -proximate and ultimate analysis of coal (method only)- metallurgical coke – manufacture by Otto-Hoffmann method -Ordinary, Premium, White and Speed Petrol - Knocking – octane number and cetane number - Gaseous fuels- water gas, producer gas, CNG and LPG. Flue gas analysis – Orsat method.

Lubricants –classification and properties- (viscosity, viscosity index, flash and fire points, cloud and pour points).

**UNIT -V** **ENGINEERING MATERIALS AND ENERGY STORAGE DEVICES** **9**

Abrasives –natural and synthetic abrasives – diamond, silicon carbide and boron carbide (properties and uses only). Engineering Plastics- classification – preparation and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-66, PET- Biodegradable plastics. Energy storage devices – Dry cell–alkaline batteries–lead–acid, nickel–cadmium and lithium ion batteries. Fuel cells – (Hydrogen – oxygen fuel cell).

**TEXT BOOKS:**


1. Jain.P.C and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi,2002.


**REFERENCE BOOKS:**


1. Sharma.B.K, "Engineering chemistry" Krishna Prakasan Media (P) Ltd.,Meerut,2001.
2. Sivasankar.B, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi,2008.
3. Roop Chand Bansal and MeenakshiGoyal, "Activated Carbon Adsorption", Taylor& Francis Group, LLC, 2005
4. Rajput.R.K, "Engineering Materials", S. Chand & Co. Pub. New Delhi, 2006
5. Samir Sarkar, "Fuels and Combustion", Orient Longman, India, 1996.


**WEB REFERENCE:**

1. www.nptel.ac.in/courses/122106028/
2. freevideolectures.com/Course/2263/Engineering-Chemistry-I
3. www.nith.ac.in/chem/chemistry.pdf

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| | |
|---|---|
| **Course Code:**140CO0105 | **Course Title: C PROGRAMMING**<br>(Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0:0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1.** Enumerate the significant aspects of software development and problem solving techniques

**CO2.** Exhibit the various types of control flow in C language

**CO3.** Illustrate the effective usage of arrays, functions and structures in C.

**CO4.** Demonstrate the implementation of pointers in arrays, structures and functions.

**CO5.** Analyze file access methods and the features of preprocessor directives

**Course Content:**

**UNIT I INTRODUCTION** 9

Introduction to computers – Computer Software – Software development life cycle - Need for studying Computer Programming Languages - Problem Definition and Analysis -Flow Chart, Developing algorithm - Procedural Programming (modular and structural)- Compilers and Interpreters - Program compilation, execution, debugging, testing - C program development environment.

**UNIT II C LANGUAGE BASICS** 9

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping. Enumerated Data type, Renaming Data type with typedef – Type Casting.

**UNIT - III ARRAYS, FUNCTIONS AND STRUCTURES** 9

**ARRAYS**: Definition- Declaration- Initialization- Assignment- Processing array- Passing array to a function-Two and multi dimensional array

**FUNCTIONS**: Defining a function- Accessing a function-Passing argument to functions- Function prototypes- Nested function call - Storage classes. Handling of character strings.

**STRUCTURES**: Definitions - processing structure-User defined data types- - Passing structure to functions –Self referential structures- Nested structures. Defining a Union- Processing union-

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Structures and unions comparison- Bit fields.

**UNIT - IV POINTERS** 9

Pointer variable declaration- Initialization and assignment- Pointers to a function- Pointers and one dimensional array and multi dimensional array- Operating a pointers- Array of pointers- Passing function to other functions. Structures and pointers – Linked Lists.

**UNIT -V FILES** 9

Introduction to files-File access-File organization-File operations (open, close, read, write, etc.)-Command line arguments. C Preprocessors – Features – Macro Expansion – File inclusion-Conditional compilation – Miscellaneous Directives – simple Header files functions.

**TEXT BOOKS:**


1. Byron Gottfried, "Schaum's Outline of Programming with C", 2nd Edition, (Indian Adapted Edition), TMH publications, New Delhi, 2006.
2. Yashwant Kanetkar, "Let Us C", 5th Edition, BPB Publications, New Delhi,2004.


**REFERENCE BOOKS:**


1. Balagurusamy.E, "Programming in ANSI C" Tata McGRaw-Hill Publishing Company Limited, New Delhi2007
2. Herbert Schildt, "C – The Complete Reference", Fourth Edition, Tata McGraw Hill publishing Company, New Delhi, 2005.
3. Behrouz.A.Forouzan and Richard.F.Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks-Cole Thomson Learning Publications,UK,2007.
4. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India),New Delhi, 2008.


**WEB REFERENCE:**

1. Introduction to programming in C. URL: http://nptel.ac.in/courses/106104128/
2. Practical Programming in C URL: http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/lecture-notes/
3. www.iups.org/media/meeting_minutes/C.pdf

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| | |
|---|---|
| **Course Code:** 140EI0106 | **Course Title: BASICS OF CIVIL AND MECHANICAL ENGINEERING** (Common to CSE, IT, ECE, EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0:0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO 1:** Outline the various Civil Engineering materials used in field and understand the importance of surveying

**CO 2:** Identify the principle behind architectural aspects involved in construction and Illustrate the techniques involved in construction of substructure and superstructure

**CO 3:** Recognize the various manufacturing process for making a product.

**CO 4:** Decide various parameters in designing air conditioning and refrigeration systems.

**CO 5:** Define the fundamentals of I.C Engine and its principle of working

**Course Content:**

## A. CIVIL ENGINEERING

**UNIT I CIVIL ENGINEERING MATERIALS & SURVEYING 8**

Infrastructure projects- Role of civil Engineers, Basic areas in Civil Engineering and its scope - Civil Engineering Materials and classification - stones, bricks, sand, aggregate, cement & types of cement, mortar, concrete, concrete grades, types of concrete, Plain cement concrete (PCC) - Reinforcement cement concrete(RCC), surveying objectives and types, common methods and instruments for distance and angle measurements.

**UNIT II PRINCIPLES OF ARCHITECTURAL DESIGN 7**

Aesthetic qualities in building to include, unity, proportion, scale, balance, symmetry and rhythm – study of examples, Factors in architectural design, such as: requirements, circulation, anthropometrics, site & landscape, climate, space standards, safety regulations, layout regulations, building rules , Basic services – basics of interior design and landscaping, Integration of building services.

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**UNIT - III BUILDING COMPONENTS** 8

Sub structure: Nature of soil – problems with soil, selection of foundation based on soil condition – functions of foundation, Bearing capacity - requirement of good foundations. Super structure: types of masonry – brick masonry, stone masonry, Beams, columns, Lintels & floors.

## B. MECHANICAL ENGINEERING

**UNIT - IV MANUFACTURING PROCESSES** 8

Metal Forming - Forging, Rolling, Extrusion processes. Metal Casting - Foundry – Moulding and Casting Processes, Welding, Metal Machining – Turning, Milling, Grinding, Shaping, Planing.

**UNIT -V REFRIGERATION AND AIR CONDITIONING** 7

**Refrigeration:** Principle of vapor compression system – Layout of typical domestic refrigerator, Refrigerants – types and properties.

**Air Conditioning:** Air conditioning – Definition, working principle of Window and Split type room air conditioners.

**UNIT -VI IC ENGINES** 7

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Two stroke and Four stroke cycles – Comparison of two stroke and four stroke engines.

**TEXT BOOKS:**


1. Jayagopal.L.S&Rudramoorthy.R, "Basic Civil and Mechanical Engineering",Vikas Publishing House, New Delhi, 2001.
2. Shanmugam.G and Palanichamy.M.S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi, 1996.


**REFERENCE BOOKS:**


1. Bindra.S.P and Arora.S.P,"The text book of Building construction", DhanpatRai Publications (P) Ltd., New Delhi, 2011.
2. Francis.D.K.Ching, " Architecture: Form, Space and Order ", VNR, New York, 1999.
3. Ananthanarayanan.P, "Basic Refrigeration and Air Conditioning", Tata McGraw Hill Publishing Co., New Delhi, 2003.
4. Srinivasan.S, "Automotive engineering" Tata McGraw Hill Publishing Co., New Delhi, 2003.


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| | |
|---|---|
| **Course Code:** 140EI0107 | **Course Title: ENGINEERING PRACTICES LABORATORY** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1**. Explain the use of hand tools and equipments used in fabrication workshop.

**CO2.**Select the various tools and equipments used in the fabrication workshop.

**CO3.** Make a basic pipe connection using mixed pipe materials and joining component

**CO4.** Demonstrate basic carpentry work using power tool.

**CO5.** Demonstrate the working of domestic appliances.

**List of Experiments:**

**I. CIVIL ENGINEERING PRACTICE**

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

**(a) Plumbing Works:**

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
2. Hands on exercise on basic pipe connections – mixed pipe material connection – pipe connections with different joining components.

**(b) Carpentry works:**

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
3. Demonstration on Carpentry using Power Tools only.

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## II MECHANICAL ENGINEERING PRACTICE

**(a) Welding:**

1. Study of welding processes, tools and safety aspects.
2. Hands on exercise for making butt joints, lap joints and tee joints using arc welding.
3. Hands on exercise on Gas welding practice.

**(b) Sheet Metal Work:**

1. Study of sheet metal works, tools and measuring instruments.
2. Hands on exercise on:
   (i) Forming & bending.
   (ii) Model making – Trays, Funnels, Cones etc.

**(c) Machine assembly practice:**

1. Centrifugal Pump

**(d) Demonstration on:**

1. Turning, milling and drilling practices.
2. Smithy operations, upsetting, swaging, setting down and bending. Example
3. Foundry operations like mould preparation for gear and step cone pulley.
4. Fitting – Preparation of square fitting and vee – fitting models.
5. Air-conditioner.
6. Working of IC Engine

**REFERENCES:**


1. Jeyachandran.K, Natarajan.S. &Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.
2. Rajendra Prasad.A&Sarma.P.M.M.S, "Workshop Practice", SreeSai Publication, 2002.
3. Kannaiah.P&Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 1999.


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| | |
|---|---|
| **Course Code:** 140CO0108 | **Course Title: C PROGRAMMING LABORATORY** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0105 C PROGRAMMING

**Course Outcomes:**

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

**CO1.** Infer the skills in data processing

**CO2.** Develop program using suitable programming constructs.

**CO3.** Write, compile and debug programs in C language

**CO4.** Apply and practice logical ability to solve application oriented problems.

**CO5.** Choose appropriate programming components to solve real-world computing problems

**List of Experiments:**

1. Program to process Data types, formatting inputs and outputs.
2. Program using operators and Expression Evaluation
3. Program using decision making
4. Program using looping Statements.
5. Program using Functions
6. Program using Arrays
7. Program for String Handling
8. Program using Structures
9. Program using Pointers
10. Program on basic File Operations
11. Develop a mini project implementing the concepts from 1 to 10.

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## SEMESTER II

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|---|---|
| **Course Code:** 140CO0201 | **Course Title: COMMUNICATION SKILLS** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 2 : 0: 2 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0101- Technical English

**Course Outcomes:**

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

**CO1** Use listening skills for academic and professional purposes

**CO2** Inculcate and develop the habit of reading.

**CO3** Speak effectively in real life situations.

**CO4** Write letters and reports effectively in formal & business situations.

**CO5** Use appropriate vocabulary in different business contexts

**Course Content:**

**UNIT I LISTENING** **6+6**

Listening to fill up gapped texts -Listening to identify context and Speaker's opinion-Note Taking-Listening to Conversation.

**UNIT II READING** **6+6**

Exposure to different reading techniques-Skimming, identifying the topic sentence and its role in each paragraph-Scanning - Inferring and identifying the lexical and textual message-Comprehension & Note Making.

**UNIT - III SPEAKING** **6+6**

Verbal and Non-verbal Communication-Introducing Oneself-Describing objects and Situations-Expressing opinions - Agreement & Disagreement-Group Discussion- Mock interview-Power Point Presentation-Soft Skills-Behavioral attitude, Dress code, Dining etiquette.

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**UNIT - IV TECHNICAL REPORT WRITING** **6+6**

Writing Business Messages (Advertisement), Caption, Slogan Writing- Documentation-Preparation of Brochure, Pamphlets, notices, agenda, minutes- Writing Business Letters- calling for quotations, placing orders, a letter of complaint regarding manufacturing defects, seeking permission to use certain facilities in a company-Preparation of comparative statements-Letter of application - content, format & Resume writing- E-Mail, Memos & Proposals-Process Description, Analytical Writing, Argumentative Writing-Writing Instructions-Proof Reading.

**UNIT -V VOCABULARY** **6+6**

Word formation-prefixes &suffixes - Abbreviations and Acronyms - Foreign Words and Phrases - British & American English -Idioms and phrases (computer- related) - Scientific and technical terms-jargons-Technical Register-Pairs of confused words.

**TEXT BOOKS:**


1. Sangeetha Sharma &Binod Mishra, "Communication Skills for Engineers and Scientists", PHI Learning Private Limited, New Delhi, 2009.


**REFERENCE BOOKS:**


1. Halliday.M.A.K, An introduction to Functional English Grammar, Edward Arnold Publishers Ltd.,U.S.A,1985
2. Walter.E.Oliu., Writing That Works- How to Write Effectively on the Job, St.Martin's Press, New York, 1980
3. Joe Ayres, Effective Public Speaking, Brown Company Publishers, 1983
4. Richard Huseman, Business Communication-Strategies and Skills, Alger Press, 1988
5. Herta.A.Murphy, Effective Business Communication, McGraw-Hill Ryerson, 1990
6. Martin Hewings, Advanced English Grammar, CambridgeUniversity Press, 1999


**WEB REFERENCE:**

1. www.skillsyuneed.com/ips/nonverbal-communication.html
2. www.skillsyouneed.com/general/soft-skills.html
3. https://www.englishclub.com/vocabulary/british-american.html

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| | |
|---|---|
| **Course Code:** 140CO0202 | **Course Title: ENGINEERING MATHEMATICS-II** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0102 - Engineering Mathematics – I

**Course Outcomes:**

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

**CO1**. Solve second and higher order linear ordinary differential equations.

**CO2.** Understand the concepts of vector differentiation and integration.

**CO3.** Use the functions of a complex variable and construct analytic functions.

**CO4.** Use the concept of complex integration to solve contour integrals.

**CO5.** Apply the Laplace transform techniques to solve differential equations.

**Course Content:**

**UNIT I DIFFERENTIAL EQUATIONS 9+3**

Second and third order linear differential equations with constant coefficients -Method of variation of parameters-Cauchy and Legendre's linear equations for variable coefficients-Simultaneous first order linear equations with constant coefficients.

**UNIT II VECTOR CALCULUS 9+3**

Gradient, divergence and curl, irrotational and solenoidal vector fields- Directional derivatives-Green's theorem in a plane (without proof)-Gauss divergence theorem (without proof) - Stoke's theorem (without proof)-Verification and evaluation of integrals using Green's, Gauss's and Stoke's theorem.

**UNIT - III ANALYTIC FUNCTIONS 9+3**

Function of a complex variable-Analytic function -Singular points –Cauchy Riemann equations-Sufficient conditions (without proof) – Properties-Construction of analytic functions-Conformal mapping: Bilinear transformation, Special mappings: $w = z + a,\ \ w = az,\ \ w = 1/z$.

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**UNIT - IV COMPLEX INTEGRATION** **9+3**

Taylor and Laurent expansions- Types of singularity -Cauchy's fundamental theorem (without proof) – Residues-Cauchy Residue theorem-Evaluation of integrals –Applications: Evaluation of real integrals using Contour integration with no poles on the real axis.

**UNIT -V LAPLACE TRANSFORM** **9+3**

Laplace transform-Conditions for existence-Transform of elementary functions- Properties-Transform of derivatives, integrals, unit step function and unit impulse function – Transformation of periodic functions-Inverse Laplace transform-Convolution theorem-Initial and final value theorems-Solution of linear ODE of second order with constant coefficients using Laplace transform.

**TEXT BOOKS:**


1. Veerarajan.T, "Engineering Mathematics", Updated 2nd Edition, Tata McGraw Hill, NewDelhi, 2010.
2. Ramakrishna Prasad.A, "Kreyszig's Engineering Mathematics I", 1st Edition, Wiley India Pvt. Ltd., India, 2011.


**REFERENCE BOOKS:**


1. Venkatraman.M.K, "Engineering Mathematics-Volume II", 5th edition, National publishing company, Chennai, 2007
2. Kandasamy.P, Thilagavathy.K, Gunavathy.K,"Engineering Mathematics", Revised 9th Edition,S. Chand and Company Ltd., New Delhi, 2011.
3. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
4. Louis.C.Barrett, Ray Wylie.C, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Publishing Company Ltd, New Delhi, 2003.


**WEB REFERENCE:**

1. http://nptel.ac.in/
2. http://ocw.mit.edu/courses/mathematics
3. http://mathworld.wolfram.com/**laplace**.html

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|---|---|
| **Course Code:** 140CO0203 | **Course Title: MATERIAL SCIENCE**<br>(Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1.** Explain the properties of conducting materials

**CO2.** Explain the properties of semiconducting materials

**CO3.** Explain the properties and applications of magnetic and superconductors

**CO4.** Identify the types of dielectric materials and its applications

**CO5.** Describe the new engineering materials and its applications.

**Course Content:**

**UNIT I CONDUCTING MATERIALS** **9**

Formation of bands (qualitative) - Classification of solids based on bands – Classical free electron theory, Expression for electrical and thermal conductivity, Weidmann Franz law - Sources of resistivity - Mattheissen's rule. - Low and high resistivity materials and their applications.

**UNIT II SEMICONDUCTING MATERIALS** **9**

Intrinsic and extrinsic semiconductors - Expression for carrier concentration - Variation of carrier concentration and Fermi level with temperature for n – type - Elemental and compound semiconductors - Hall effect : Hall coefficient in extrinsic semiconductors, experimental determination of Hall coefficient and applications of Hall effect, LDR, Solar Cells and strain gauges.

**UNIT - III MAGNETIC MATERIALS AND SUPERCONDUCTORS** **9**

Introduction to magnetic materials - Ferromagnetic materials - Properties - Domain theory of ferromagnetism - Hysteresis - Hard and soft magnetic materials - Ferrites: structure and applications. Magnetic storage devices: magnetic recording and magneto optical recording – Materials for permanent magnets. Superconductors – Properties - Types of superconductors - High Tc superconductors - Applications: SQUID - Cryotron - Magnetic levitation.

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**UNIT - IV DIELECTRIC MATERIALS** 9

Polarization – Polarizability – Polarization vector, Electrical susceptibility, Dielectric constant - Polarization mechanisms (Qualitative) –Internal Field- Clausius Mossotti relation-Frequency and temperature dependence of polarization - Dielectric loss - Dielectric breakdown mechanisms – Ferro electric materials, Classification and its Properties –Piezoelectric materials – classification of Insulating materials.

**UNIT -V MODERN ENGINEERING MATERIALS** 9

Shape Memory alloys (SMA): Characteristics, properties of NiTi alloy. Applications of SMA. Metallic glasses: Preparation, properties and applications. Nano Materials: Top down processes: Ball Milling - Bottom up processes: Physical vapor deposition, Nanomaterials, properties and applications (Qualitative). Carbon nanotubes: Fabrication - CVD, electric arc discharge method, Properties and applications.

**TEXT BOOKS:**


1. Veerarajan.T, "Engineering Mathematics", Updated 2nd Edition, Tata McGraw Hill, NewDelhi, 2010.
2. Ramakrishna Prasad.A, "Kreyszig's Engineering Mathematics I", 1st Edition, Wiley India Pvt. Ltd., India, 2011.


**REFERENCE BOOKS:**


1. Venkatraman.M.K, "Engineering Mathematics-Volume II", 5th edition, National publishing company, Chennai, 2007
2. Kandasamy.P, Thilagavathy.K, Gunavathy.K,"Engineering Mathematics", Revised 9th Edition,S. Chand and Company Ltd., New Delhi, 2011.
3. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, New Delhi, 2007.
4. Louis.C.Barrett, Ray Wylie.C, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Publishing Company Ltd, New Delhi, 2003.


**WEB REFERENCE:**

1. http://www.physicsclassroom.com/
2. http://hyperphysics.phy-astr.gsu.edu/
3. http://www.tndte.com/TEXT%20BOOKS/Complete%20Books/Engineering%20Physics-I%20&%20II/Engineering%20Physics%20Sem%20-1%20&%202.pdf

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|---|---|
| **Course Code:** 140CO0204 | **Course Title: ENVIRONMENTAL SCIENCE** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1** Describe the ways to maintain ecological balance and preserve bio-diversity.

**CO2** Explain the causes of pollution and the methods to reduce & recycle.

**CO3** Describe the way from unsustainable to sustainable development through effective usage and conservation of energy.

**CO4** Describe the global environmental issues and the laws passed to control it.

**CO5** Describe the role of man & technology in environmental management

**Course Content:**

**UNIT I ENVIRONMENTAL SCIENCE AND BIO SYSTEMS 9**

Multidisciplinary nature of Environmental studies – Definition, Scope and Importance of Environmental studies – Natural resources– Over exploitation of resources and impacts. Ecosystem – Structure and function of an ecosystem – concept, structure and function with relevant examples- Food chain, Food web and Ecological pyramids. Biodiversity – Endemic, endangered and extinct species – Habitat – Hotspots – values of biodiversity -threats to biodiversity - conservation of biodiversity.

**UNIT II ENVIRONMENTAL POLLUTION 9**

Causes, effects and control of – Air pollution, Water pollution, Marine pollution, Thermal pollution, Noise pollution- solid waste management – types and sources of solid waste- 3R principles, advantages of recycling and waste utilization, E –waste, hazardous waste management.

**UNIT - III ENERGY AND SUSTAINABILITY 9**

Energy resources- types - the role of renewable sources of energy- Principle involved in energy conversion advantages and limitations of hydro energy, solar energy, wind energy, bio energy, geothermal energy, ocean energy. Sustainable development – equitable use of resources for sustainable development.

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**UNIT - IV GLOBAL ENVIRONMENTAL ISSUES AND LAWS 9**

Facts and impacts of - Climate change, Global warming, ozone layer depletion, waste lands. Environmental disasters - disaster management approach. International Conventions, protocols for environmental protection. Environmental ethics - Environmental protection act in India - Role of Pollution control boards.

**UNIT -V HUMAN POPULATION AND ENVIRONMENT 9**

Population growth, population explosion, environment and human health, Role of technology in environmental management. Public awareness, Eco-labeling. Role of NGO's in environmental management. Case studies.

**TEXT BOOKS:**


1. Kaushik Anubha & Kaushik.C.P "Environmental Science and Engineering", 3 rd edition, reprint 2010, New Age International Publishers, New Delhi


**REFERENCE BOOKS:**


1. William.P.Cunningham – "Principles of Environmental Science", Tata McGraw Hill, New Delhi, 2007
2. Linda.D.Williams – "Environmental Science Demystified", Tata McGraw Hill Publishing Company Limited , 2005,New Delhi,
3. Shyam Divan, Armin Rosencranz "Environmental Law and Policy in India –cases, materials and Statutes", Oxford University Press, New Delhi, 2001.
4. Gilbert.M.Masters, "Introduction to Environmental Engineering and Science", Second edition, Prentice –Hall of India private limited, New Delhi, 2004.
5. Tyler Miller.G, JR "Environmental Science ", 10th edition, Thomson Asia Private Limited, Singapore, 2004


**WEB REFERENCE:**

1. www.nptel.ac.in/courses/122106028/
2. freevideolectures.com/Course/2263/Engineering-Chemistry-I
3. www.nith.ac.in/chem/chemistry.pdf

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|---|---|
| **Course Code:** 140EI0205 | **Course Title: ELECTRICAL CIRCUIT ANALYSIS** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Examine DC circuit Theorems and network reduction techniques.

**CO2:** Analyze the basic AC circuits.

**CO3:** Determine the characteristics of resonance and coupled circuits.

**CO4:** Plot the transient response of first order and second order linear series circuits.

**CO5:** Calculate the parameters in different three phase circuits

**Course Content:**

**UNIT I D.C. CIRCUIT ANALYSIS 12**

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

**UNIT II A.C.CIRCUIT FUNDAMENTALS AND ANALYSIS 12**

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

**UNIT - III RESONANCE AND COUPLED CIRCUITS 12**

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

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**UNIT - IV** **TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS** **12**

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

**UNIT -V** **THREE-PHASE CIRCUIT ANALYSIS** **12**

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

**TEXT BOOKS:**


1. Boylsted,R.L, "Essentials of Circuit Analysis", Prentice Hall, 2003.
2. Husain.A, "Networks and Systems", Khanna Publishers, 2000.


**REFERENCE BOOKS:**


1. HAYT.W.H.Jr,Kemmerly.J.E, and Durbin.S.M, "Engineering Circuit Analysis", Tata McGraw-Hill, New Delhi, 2002.
2. Alexander.C.K, Matthew.N.O, and Sadiku, "Fundamentals of Electric Circuits", Tata McGraw- Hill, New Delhi, 2003.
3. Decarlo.R.A and Lin.P.M, "Linear Circuit Analysis", OxfordUniversity Press, New Delhi,2001.
4. Edminister.J.A, andNahvi,.M, "Electric Circuits", 4th Edition, Schaum's Outline series,McGrawHill, New Delhi,2002.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| Course Code: 140EI0206 | Course Title: ELECTRON DEVICES |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 3 : 0 : 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Basic knowledge of semiconductor physics.

**Course Outcomes:**

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

**CO1:** Describe the properties of conducting and semiconducting materials

**CO2:** Explain the properties and applications of magnetic and superconducting materials

**CO3:** Elucidate construction, working principle and characteristics of various special diodes and PN junction diode.

**CO4:** Compare the types of BJT and Field effect transistors devices.

**CO5:** Discuss about the various applications of electronic devices.

**Course Content:**

**UNIT I ELECTRON BALLISTICS AND INTRINSIC SEMICONDUCTORS** 9

Force on charge in electric field-Motion of Charge in uniform and time varying electric fields. Forces on a moving charge in a magnetic field-calculation of cyclotron frequency-calculation of electrostatic and magnetic deflection sensitivity. Energy band structure of conductors, semiconductors and insulators-Density distribution of available energy states in semiconductors-Fermi- Diac probability distribution function at different temperature. Thermal generation of carriers-calculation of electron and hole densities in intrinsic semiconductors-intrinsic concentration-Mass Action Law.

**UNIT II EXTRINSIC SEMICONDUCTOR AND PN JUNCTIONS** 9

N and P type semiconductors and their energy band structures-Law of electrical neutrality-calculation of location of Fermi level and free electron and hole densities in extrinsic semiconductors-Mobility, drift current and conductivity-Diffusion current-Continuity equation-Hall effect. Band structure of PN junction-Current Component in a PN junction-Derivation of diode equation-Temperature dependence of diode characteristics.

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**UNIT - III** **SWITCHING CHARACTERISTICS OF PN JUNCTION AND SPECIAL DIODES** **9**

Calculation of transition and diffusion capacitance -Varactor diode-charge control description of diode switching characteristics of diode-Mechanism of avalanche and Zener breakdown-Temperature dependence of breakdown voltages-Backward diode-Tunneling effect in thin barriers. Tunnel diode-photo diode-Light emitting diodes-PIN Diode –Phototransistor.

**UNIT - IV** **BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS** **9**

Construction of PNP and NPN transistors-BJT current components-Emitter to collector and base to collector current gains-Base width modulation CB and CE characteristics-Breakdown characteristics-Eber-Moll model-Transistor switching times. Construction and characteristics of JFET .Relation between Punch off voltage and drain current Derivation. MOSFETS-Enhancement and depletion types.

**UNIT -V** **METAL SEMICONDUCTOR CONTACTS AND POWER CONTROL DEVICES** **9**

Metal Semiconductor Contacts-Energy band diagram of metal semiconductor junction Schottky diode and ohmic contacts.Power control devices. Characteristics and equivalent circuit of UJT-intrinsic stand of ration .PNPN diode-IGBT-Two transistor model-SCR, Triac, Diac.

**TEXT BOOKS:**


1. Floyd.T.L, "Electronic Devices" 6th Edition, Pearson Education, 2003.
2. Millman and Halkias, "Electronic Devices and Circuits", Tata McGrawHill, New Delhi 2007.
3. Boylsted and Nashelsky, "Electronic Devices and Circuit Theory", 6th Edition, Prentice Hall of India, New Delhi, 1999


**REFERENCE BOOKS:**


1. Mottershead.A, "Electronic Devices and Circuits an Introduction",Prentice Hall of India, New Delhi 2003.
2. Streetman.B and Sanjay.B, "SolidState Electronic Devices", 5th Edition, Prentice- Hall of India, New Delhi ,2005.
3. Bell.D.A, "Electronic Devices and Circuits", 4th Edition, Prentice Hall of India, New Delhi, 1999.
4. Millman,J, Prakash Rao.M.S and Taub.H, "Pulse Digital and Switching Wave Forms", McGraw-Hill, New Delhi, 2007


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**WEB REFERENCE:**

1. http://www.physicsclassroom.com/
2. http://hyperphysics.phy-astr.gsu.edu/
3. www.nptel.ac.in/courses/

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|---|---|
| **Course Code:** 140EI0207 | **Course Title: ENGINEERING PRACTICES LABORATORY (Electrical, Electronics and PC hardware)** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1**: Draw the basic symbols of Electrical and Electronic Components.

**CO2:** Identify the various Electrical and Electronic elements.

**CO3:** Execute soldering practice for Electrical and Electronics circuits.

**CO4:** Verify basic laws and demonstrate basic wiring.

**CO5:** Apply the concepts of Electrical Engineering for real time Applications

**List of Experiments:**

**ELECTRICAL ENGINEERING PRACTICE**

1. Electrical symbols, safety aspects of electrical wiring and earthing practices.
2. Introduction to the connection of voltmeter, ammeter and multimeter.
3. Stair case wiring, assembling and testing of a fluorescent lamp circuit & fault finding.
4. Domestic lighting circuits and use of megger.
5. Diagnosing simple faults in grinder, mixie, iron box, ceiling & table fans.
6. Introduction to types of fuses, MCB and types of wires and cables.

**ELECTRONICS ENGINEERING PRACTICE**

1. Symbols of basic electronic components and equipments.
2. Color coding of resistors and identification of capacitor values.
3. Study and method of using CRO, function generator, power supply units with fault identification and trouble shooting.
4. Study of AC signal parameters (amplitude, frequency, phase) using CRO.
5. Logic gates (AND, OR, NOT, NAND, NOR, EX-OR).
6. Soldering and testing a given simple electronic circuits using PCB.

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**COMPUTER HARDWARE**

1 a) Study of PC hardware

b) Assembling the computer system

2 a) Formatting and Partitioning HDD

b) Configuring CMOS-Setup

c) Installation of OS

**REFERENCES:**


1. Jeyachandran.K, Natarajan.S&Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, Tamilnadu (India), 2007.
2. Jeyapoovan.T, M.Saravanapandian&Pranitha.S, "Engineering Practices Lab Manual", VikasPuplishing House Pvt.Ltd.,Uttar Pradesh (India), 2006.
3. Rourke.J&Zacker.C, "The complete reference", Tata McGraw Hill publishing company Ltd, Uttar Pradesh (India), 2001.
4. Gilster& Ron, "A Beginners Guide", Tata McGraw Hill publishing company Ltd, Uttar Pradesh (India), 2001.


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| Course Code: 140EI0208 | Course Title: CIRCUITS AND DEVICES LABORATORY |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 0 : 0 : 3 : 2 : 100 |
| Type: Practical | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Compute the voltage and current of a given circuit by verifying experimentally through theorems

**CO2:** Verify the characteristics of various electronic devices such as diodes and transistors

**CO3:** Plot the frequency response of series and parallel resonance circuits

**CO4:** Verify the characteristics of TRIAC and DIAC

**CO5:** Verify the characteristics of Photodiode and phototransistor

**List of Experiments:**

1. Verification of KVL and KCL
2. Verification of Thevenin and Superposition Theorem.
3. Verification of Maximum power transfer and reciprocity theorems.
4. Frequency response of series and parallel resonance circuits.
5. Characteristics of PN and Zener diode
6. Characteristics of CE and CB configuration of a Transistor.
7. Characteristics of UJT and SCR
8. Characteristics of JFET
9. Characteristics of Diac and Triac.
10. Characteristics of Photo diode and Photo transistor.

**REFERENCES:**


1. Lab manual by ECE Department
2. David.A.Bell "Fundamentals of Electronic Devices and Circuits Lab manual" Fifth Edition, Oxford university Press, New Delhi,2009
3. Sasikala.B, Poornachandra Rao, "Handbook of experiments in Electronics and Communication Engineering" UBS Publisher's Distributors, Vikas Publishing House (P) Ltd. New Delhi, 2003.


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|---|---|
| **Course Code:** 140CO0209 | **Course Title: ENGINEERING GRAPHICS**<br>(Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 2 : 0 : 3 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Sketch different curves and explain its application.

**CO2:** Prepare orthographic projection from pictorial views and models.

**CO3:** Draw the projection of solids and sectioned solids.

**CO4:** Draw the development of surfaces of simple solids with cuts and slots.

**CO5:** Prepare Drawings using CAD Package

**Course Content:**

**UNIT I INTRODUCTION TO ENGINEERING GRAPHICS** **15**

Importance of graphics in engineering applications – General principles of engineering graphics – principles of orthographic projection – angles of projection - multiple views and their placement – layout of views.

Use of conventional drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Methods of Dimensioning.

Geometric shapes of objects - Mathematical representation of geometrical shapes - their engineering applications – Construction of polygonal shapes, their importance and application.

Conics sections – Construction of ellipse, Parabola and hyperbola by eccentricity method – construction of cycloid and involutes of square and circle – construction of spirals and helices – Meaning of tangents and normal to the above curves.

**UNIT II PROJECTION OF LINES, PLANES AND SOLIDS** **15**

Projection of points and lines- Concept of polygonal surfaces and circular lamina inclined to both reference planes – Concept of true lengths and true inclinations.

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to two reference plane.

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**UNIT - III DEVELOPMENT OF SURFACES AND SECTIONS OF SOLIDS 15**

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

Need for sectioning of solids – Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other. – Orthographic views of sections of simple solids.

**UNIT - IV ORTHOGRAPHIC AND ISOMETRIC PROJECTION OF SOLIDS 15**

Orthographic projection of solids – Practices on three view projection of solids.

Isometric Projection of solids – practices on simple solids

**UNIT -V SOLID MODELING AND CIVIL DRAWINGS 15**

Need and advantages of modeling software over conventional drawing methods - Representation of three Dimensional objects –3D modeling techniques – constructive solid geometry (CSG) and boundary representation (BRep) techniques - Boolean operations, extrude, revolve, mirror, array, etc. Modeling of isometric views of engineering components.

Introduction to perspective projection .Meaning of house plans-different types representation of different details-meaning of area of a house and site.

**REFERENCE BOOKS:**


1. Dhananjay.A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Bhatt.N.D, "Engineering Drawing "46th Edition, Charotar Publishing House , Gujarat, India, 2003
3. Basant Agarwal and Agarwal.C.M, "Engineering Drawing", Tata McGraw Hill PublishingCompany Limited, New Delhi, 2008.
4. Gopalakrishnan.K.R, "Engineering Drawing" (Vol. I&II), Subhas Publications, Chennai, 1998.
5. Natrajan.K.V, "A text book of Engineering Graphics", Dhanalakshmi Publisher, Chennai, 2006.
6. Manuals of 2D and 3D Modeling software packages


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| | |
|---|---|
| **Course Code:** 140CO0210 | **Course Title: ENGINEERING PHYSICS AND CHEMISTRY LABORATORY** (Common to all B.E / B.Tech Programmes Except AU and ME) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Measure optical parameters of laser and optical fiber

**CO2:** Estimate electrical properties of metal and semiconductor

**CO3:** Estimate the total hardness of water

**CO4:** Measure corrosion rate of a mild metal

**CO5:** Determine concentration of a solution through electrical method

**List of Experiments:**

**A. ENGINEERING PHYSICS LABORATORY**

1. Velocity of ultrasonic waves and compressibility of given liquid - ultrasonic interferometer
2. Wavelength of laser and particle size determination using laser
3. Insulation of thin wire – Interference technique
4. Thermal conductivity of insulator - Lee' disc method
5. Band gap of a Thermistor – Post office box
6. Resistivity of metal and alloy – Carey Foster's bridge
7. Band gap of a diode – Reverse characteristics
8. Thermal conductivity of metallic wire - Meter bridge method
9. Numerical aperture of the given optical fiber
10. Hysteresis Loss of a ferromagnetic material
11. Study of characteristics of given LDR
12. Efficiency of Solar Cell

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13. Rigidity modulus of metallic wire -Torsional pendulum method
14. Young's modulus of the material - Cantilever method
15. Co-efficient of viscosity of the liquids
16. Hall coefficient determination
17. Dielectric constant determination

## B. CHEMISTRY LABORATORY

### WEIGHING AND PREPARATION OF STANDARD SOLUTIONS

Preparation of molar and normal solutions of oxalic acid, sodium carbonate and standard hard water.

### WATER ANALYSIS

i) Determination of total, temporary and permanent hardness of water sample by EDTA method.

ii) Determination of Dissolved oxygen content by Winkler's method

iii) Determination of COD of waste water by dichromate method

iv) Determination of heavy metals in water by spectrophotometry (any one-Iron, Cr, Hg)

### VISCOMETRY

v) Determination of molecular weight of a polymer

### ELECTROCHEMISTRY

vi) To determine the strength of given acid – pH metrically

vii)To determine the amount of ferrous ions by potentiometry

viii) Determination of emf of electrochemical cell

ix) Determination of corrosion rate – weight loss method

x) Determination of inhibitor efficiency – corrosion

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## SEMESTER III

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|---|---|
| **Course Code:** 140EI0301 | **Course Title: ENGINEERING MATHEMATICS–III** (Common to CSE, EEE, EIE, and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0102 Engineering Mathematics I
- 140CO0202 Engineering Mathematics II

**Course Outcomes:**

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

**CO1:** Describe vector spaces and its properties.

**CO2:** Compute the Fourier series expansion for given periodic functions.

**CO3:** Calculate Fourier transform for aperiodic functions.

**CO4:** Determine the solution of first and second order PDE.

**CO5:** Solve one dimensional wave equation, one dimensional heat and two dimensional heat flow equations.

**Course Content:**

**UNIT I LINEAR ALGEBRA** **9+3**

Vector spaces, subspaces, basis and dimension - Systems of linear equations, linear transformations - Kernel and Image - Geometric ideas - Inner product spaces - Orthogonality - Orthogonal basis- Reflections and Orthogonal maps of the plane - Orthogonal complements and Projections.

**UNIT II FOURIER SERIES** **9+3**

Fourier series – Dirichlet's conditions - Half range Fourier cosine and sine series - Parseval's identity - Fourier series in complex form - Harmonic analysis.

**UNIT - III FOURIER TRANSFORMS** **9+3**

Fourier transforms - Fourier cosine and sine transforms - inverse transforms - convolution theorem and Parseval's identity for Fourier transforms - Finite cosine and sine transforms.

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**UNIT - IV PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

**UNIT -V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION** **9+3**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded)
- Fourier series solutions in Cartesian coordinates.

**TEXT BOOKS:**


1. Venkataraman, M.K., "Engineering Mathematics Vol.4", National Publishing Company, 2004.
2. Veerarajan, T., "Transforms and Partial Differential Equations", Tata McGraw HillPublishing Company Limited, 2012
3. David C. Lay., "Linear Algebra and its applications," 3rd edition, Pearson Education India Ltd., 2003.


**REFERENCE BOOKS:**


1. Grewal. B. S.,"Higher Engineering Mathematics", 40th edition, Khanna Publishers,2007, New Delhi.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, 2007, New Delhi.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India, 2007.


**WEB REFERENCE:**

1. elearning.vtu.ac.in/P5/enotes/MAT31/S1-ATE.pdf
2. www.tolani.edu/.../john_bird_engineering_mathematics_0750685557.pd
3. julianoliver.com/share/free...books/essential-engineering-mathematics.pdf

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| | |
|---|---|
| **Course Code:** 140EI0302 | **Course Title: THERMAL ENGINEERING AND FLUID MECHANICS** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO 1:** Explain the fundamentals of thermodynamics.

**CO 2:** Calculate the performance of gas and vapour power cycles

**CO 3:** Determine the performances of air compressors and refrigeration systems

**CO 4:** Illustrate properties of fluids and application of the conservation laws

**CO 5:** Explain the construction and performance analysis of hydraulic turbines and pumps

**Course Content:**

**UNIT I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 8+3**

Classical approach: Thermodynamic systems – Control volume – System and surroundings – Universe – Properties – State–Process – Cycle – Equilibrium – Work and heat transfer – Point and path functions – First law of thermodynamics for open and closed systems – First law applied to a control volume – SFEE equations [steady flow energy equation] – Second law of thermodynamics– Heat engines – Refrigerators and heat pumps – Carnot cycle – Carnot theorem (Qualitative).

**UNIT II IC ENGINES & STEAM TURBINE 8+3**

Air standard cycles: Otto, diesel and dual cycles and comparison of efficiency – Application of IC engines. Formation of steam – Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) – Steam turbines: Impulse and reaction principle.

**UNIT - III COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 10+3**

Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio – Volume rate – Conditions for perfect and imperfect inter cooling – Multi stage with inter cooling (Qualitative)– Construction and working principle of centrifugal and axial flow compressors.

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Refrigeration – Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P–H and T–S diagram – Saturation cycles – Air–conditioning systems, Types of air conditioning systems – Selection criteria for a particular application.

**UNIT - IV FLUID PROPERTIES & FLOW THROUGH PIPES** **10+3**

Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics – concepts of system and control volume. Application of control volume to continuity equation, Momentum Equation, Darcy – Weisbach equation. Friction factor. Minor losses. Flow through pipes in series and in parallel.

**UNIT -V TURBINE & PUMPS** **9+3**

Homologous units – Specific speed. Theory of turbo machines. Euler"s equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor – Velocity triangle for single stage radial flow and axial flow machines – Centrifugal pumps, turbines, performance curves for pumps and turbines. Reciprocating pumps – Indicator diagrams, Work saved by air vessels – Rotary pumps – Classification. Working and performance curves.

**TEXT BOOKS:**


1. Khurmi.R.S.& Gupta.J.K., "Thermal Engineering", S.Chand& Co. Ltd., 2006.
2. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi.


**REFERENCE BOOKS:**


1. Rogers and Mayhew, "Engineering Thermodynamics – Work and Heat Transfer", Pearson Education Pvt. Ltd., 2006.
2. Eastop and McConkey, "Applied Thermodynamics", Pearson Education Pvt. Ltd, 2002.
3. Nag.P.K., "Engineering Thermodynamics" Tata McGraw Hill, 2003.
4. Rajput, B.K. Sankaar, "Thermal Engineering", S.Chand& Co. Ltd., 2003.
5. Kumar. K.L., "Engineering Fluid Mechanics" Eurasia Publishing House (P) Ltd., 7th edition, 1995.


**WEB REFERENCE:**

1.www.accessengineeringlibrary.com

2. www. nptel.ac.in

3.www.engineeringtoolbox.com

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| | |
|---|---|
| **Course Code:** 140EI0303 | **Course Title: TRANSDUCER ENGINEERING** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0103 - Engineering Physics

**Course Outcomes:**

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

**CO1:** Analyze the characteristics and performance of transducers.

**CO2:** Explain the principle and application of resistance transducers.

**CO3:** Describe the principle and application of variable inductance and capacitance transducers.

**CO4:** Select suitable transducer based on the application.

**CO5:** Illustrate the advanced types of transducers.

**Course Content:**

**UNIT I CHARACTERISTICS OF TRANSDUCERS** 9

Units and standards – Calibration methods – Static calibration – Classification of errors – Error analysis – Statistical methods and curve fitting – Odds and uncertainty – Classification of transducers-Static and dynamic characteristics – Mathematical model of transducer – Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs.

**UNIT II VARIABLE RESISTANCE TRANSDUCERS** 9

Principle of operation, construction details, characteristics and application of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezoresistive sensor and humidity sensor.

**UNIT - III VARIABLE INDUCTANCE AND CAPACITANCE TRANSDUCERS** 9

Induction potentiometer – Variable reluctance transducers – EI pick up – Principle of operation, construction details, characteristics and application of LVDT –Capacitive transducer and types – Capacitor microphone – Frequency response.

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**UNIT - IV OTHER TRANSDUCERS AND SELECTION OF TRANSDUCERS 9**

Piezoelectric transducer- operation and application- Hall Effect transducer – Different types of Photo detectors- Thermocouple- Selection of transducers – Data sheet interpretation.

**UNIT -V SPECIAL TRANSDUCERS 9**

Digital transducers – Smart sensors - Fiber optic sensors, Film sensors, MEMS – Nano sensors – Radar and its applications-Position sensing transducers – Vibration sensing transducers.

**TEXT BOOKS:**

1. Renganathan.S., "Transducer Engineering", Allied Publishers, 1999.

**REFERENCE BOOKS:**

1. Doebelin.E.A., 'Measurement Systems – Applications and Design', Tata McGraw Hill, New York, 2000.
2. Hermann K.P.Neubert, 'Instrument Transducers:an Introduction to their performance and design', Clarendon Press, 1975,2nd edition, Illustrated.
3. Patranabis.D., 'Sensors and Transducers', Prentice Hall of India, 1999.
4. John A. Allocca, Allean Stuart 'Transducer Theory and Applications', Reston publishing Company, 1984.

**WEB REFERENCE:**

1. nptel.ac.in/courses/112103174
2. http://nptel.ac.in/courses/108105064
3. http://nptel.ac.in/courses/112106140

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| | |
|---|---|
| **Course Code:** 140EI0304 | **Course Title: OBJECT ORIENTED PROGRAMMING CONCEPTS** (Common to CSE, EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0105-C Programming

**Course Outcomes:**

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

**CO1:** Describe Object-oriented paradigm with their fundamentals

**CO2:** Implement Object Oriented concepts in C++

**CO3:** Implements the concepts of basic exception handling mechanisms

**CO4:** Describe the file organization and the usage of file systems

**CO5:** Explain the fundamentals of Java programming.

**Course Content:**

**UNIT I INTRODUCTION** **9**

Object-oriented paradigm, elements of object oriented programming – Merits and demerits of OO methodology – C++ fundamentals – data types, operators and expressions- control flow- arrays- strings- pointers and functions.

**UNIT II PROGRAMMING IN C++** **9**

Classes and objects – Access Specifiers - Constructors and Destructors- Inheritance– Polymorphism- Operator overloading-Virtual functions.

**UNIT - III TEMPLATES AND EXCEPTION HANDLING** **9**

Function and class templates -Exception handling – try-catch-throw paradigm – exception specification – terminate and unexpected functions – Uncaught exception.

**UNIT - IV FILE HANDLING** **9**

C++ streams – console streams – console stream classes-formatted and unformatted console I/O operations, manipulators - File streams - classes file modes file pointers and manipulations file I/O.

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**UNIT -V JAVA FUNDAMENTALS** 9

An overview of Java, data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance-Exception Handling.

**TEXT BOOKS:**


1. Herbert Schildt, "The Complete Reference:C++", Fourth edition, Tata McGraw Hill, Noida, 2007.
2. Deitel.H.M, Deitel.P.J, "Java: How to program", Fifth edition, Prentice Hall of India private limited,New Delhi, 2009.


**REFERENCE BOOKS:**


1. Ira Pohl, "Object oriented programming using C++", Pearson Education Asia, 2007.
2. Malik.D.S, "C++ Programming from Problem Analysis to Program Design", 3rd Edition, Thomson course Technology, New Delhi, 2007.
3. John.R.Hubbard, "Programming with C++", Schaums outline series,Tata McGraw Hill, New Delhi,2003.
4. Herbert Schildt, "The Complete Reference:Java2", Fifth edition,Tata McGraw Hill, Noida, 2007.


**WEB REFERENCE:**

1. Introduction to C++ URL : http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture-notes/,
2. Java lectures URL: http://www.cse.iitb.ac.in/~nlp-ai/java%20ppt/
3. Object-Oriented Programming with ANSI-CAxel-Tobias Schreiner , 1999http://www.cs.rit.edu/~ats/books/ooc.pdf

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| Course Code: 140EI0305 | Course Title: ELECTRONIC CIRCUITS |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 3 : 0 : 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electron Devices

**Course Outcomes:**

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

**CO1:** Analyze various rectifiers with adequate filters.

**CO2:** Design various biasing circuits of transistors.

**CO3:** Design various amplifier circuits.

**CO4:** Explain the advantages and method of analysis of feedback.

**CO5:** Design various wave shaping circuits.

**Course Content:**

**UNIT I RECTIFIERS, FILTERS AND REGULATORS** 9

Rectifiers-Single phase half wave and full wave rectifier and bridge rectifier using diodes- ripple factor- rectification efficiency- transformer utilization factor- rectifier with inductive filter and Capacitor filter- L Section Filter- π Section Filter -series voltage regulation- shunt voltage regulation- SMPS.

**UNIT II BJT BIASING AND FET BIASING** 9

Transistor Characteristics: CB, CE, CC configurations-Transistor as an Amplifier and Switch-Biasing- Operating point- thermal runaway- stabilization technique- fixed bias- collector to base bias- emitter bias- voltage divider bias-. JFET characteristics and parameters-JFET biasing –MOSFET Characteristics and parameters-MOSFET Biasing.

**UNIT - III AMPLIFIERS** 9

Small signal low frequency transistor amplifier circuits: h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters. Power Amplifiers: Class A, B, AB and C operation- Efficiency of class A and B- amplifier distortion- Push-Pull amplifier and Complimentary Symmetry amplifiers.

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**UNIT - IV FEEDBACK AMPLIFIERS AND OSCILLATORS** 9

Feedback Amplifiers: Positive and negative feedback- types of negative feedback- typical circuits- effect of negative feedback in amplifier performance. Oscillators: Barkhausen criterion- classification of oscillators- RC phase shift- Hartley, Wien bridge and crystal oscillators.

**UNIT -V WAVE SHAPING AND MULTIVIBRATOR CIRCUITS** 9

Wave shaping circuits- Differentiator- Integrator-Diode clippers- clampers- Multivibrators – Monostable- Astable -Bistable-Schmitt trigger.

**TEXT BOOKS:**


1 Robert L. Boylestad and Louis Nashelsky," Electronic Devices and circuit Theory",PHI Tenth Edition,2009.

2 Millman, Halkiasand SatyabrathaJit, Electronic devices and circuits, Tata McGraw Hill publishing company ltd., 2007.


**REFERENCE BOOKS:**


1. Allen Mottershead,"Electronic Devices and Circuits:AnIntroduction",PHI, 1998
2. David A. Bell," Electronic Devices and Circuits", OxfordUniversity Press,2008.
3. Sedha.R.S.," A text book of Applied Electronics" , S.Chand& Company Ltd.,2004.
4. Salivahanan.S., suresh Kumar.N., Vallavaraj.A.," Electronic Devices and Circuits", The Tata McGraw Hill publications, Second Edition, 2008.


**WEB REFERENCE:**

1. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html

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| Course Code: 140EI0306 | Course Title: ELECTRICAL MACHINES AND MEASUREMENTS |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 3 : 0 : 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0103 - Engineering Physics

**Course Outcomes:**

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

**CO1:** Illustrate the constructional details and working principle of transformer
**CO2:** Explain the construction and working principles of DC machines and study their performance.
**CO3:** Explicate the construction and working principles of AC machines and study their performance
**CO4:** Elucidate the construction and working principles of special machines
**CO5:** Describe the various measurement techniques and calibration.

**Course Content:**

**UNIT I TRANSFORMERS** 9

Transformers –Principles- e.m.f equation – Construction – Efficiency and Voltage regulation of a Transformer- Auto Transformer – Three phase Transformer – Connection methods – Construction of three phase Transformer- Current Transformer and Potential Transformer-. Scott Connection and Centre tap Transformers.

**UNIT II DC MACHINES** 9

DC Machines. Armature and field connection General arrangement of DC machine. E.M.F generated in DC machine- DC Generator- Series, Shunt and Compound wound generators - Application of DC generators- DC motors –Torque equation for DC motor- Torque – speed Characteristics of DC series, shunt and Compound motors. Starter for DC shunt motors – Electronic speed Control of DC Shunt motor.

**UNIT - III AC MACHINES** 9

AC Machines- General arrangement of synchronous machines- Types of rotor Construction- Stator windings- emf generated in synchronous generator- Armature reaction- Voltage regulation of Synchronous generator- Synchronous Impedance- Induction motor – Construction – Slip ring and Cage Rotors- Principle of rotating magnetic field theory- Torque Speed Characteristics – Starting methods- Speed Control of Induction motor.

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**UNIT - IV SPECIAL MACHINES** 9

Motors for Regulators – Stepping motors – Variable Reluctance motor- Hybrid Stepping motors - Drive circuits- DC and AC servo motor – Synchros- Differential synchros- Synchro Transmitter and receiver – Single phase Induction motor Capacitor RUN , split phase and shaded pole motors- Linear Induction motor.

**UNIT -V MEASUREMENT** 9

Electrical Analog Indicating Instruments – Controlling Devices – Damping Devices – PMMC Ammeter and Voltmeter – Measurement of Resistance by the Wheatstone Bridge method- Calibration of Ammeter- Calibration Voltmeter- Watt meters- Connection of watt meters- Measurement of 3 phase power -3 wire and 4 wire supply-CTs and PTs.

**TEXT BOOKS:**


1. Bhattacharya.S.K.,"ElectricalMachines",Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Sawhney. AK., – PuneetSawhney, "A Course in Mechanical Measurements & Instrumentation, Twelfth edition", DhanpatRai& Co., New Delhi, 2006.


**REFERENCE BOOKS:**


1. Kothari. D.P. and Nagrath. I.J., "Electrical Machines", Fourth edition, Tata McGraw-Hill Ltd. New Delhi, 2010.
2. Hughes,"Electrical Technology", Eighth edition revised by I. Mckenzie Smith, Addison – Wesley Longman, Inc. [Eastern Press Bangalore ], 2002.
3. Ernest Doeblin,"Measurement Systems – Application and Design", Second Edition, Tata McGraw-Hill Ltd. New Delhi, 2004.
4. Bhimbra. P. S.,"ElectricalMachinery",Khanna Publishers, Delhi.
5. Fitzerald, Kingsley,"ElectricalMachinery",Tata McGraw Hill,Sixth Edition 2004.
6. Thereja. BL. and Thereja. AK., "A Text Book of Electrical Technology", Vol.I, S.Chand, New Delhi, 2010.


**WEB REFERENCE:**

1. www.nptel.ac.in/courses/108105017
2. www.nptel.ac.in/courses/108106072
3. http://nptel.ac.in/courses/108105053

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| | |
|---|---|
| **Course Code:** 140EI0307 | **Course Title: THERMAL ENGINEERING AND FLUID MECHANICS LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Draw the valve and port timing diagram of IC engine.

**CO2:** Evaluate the performance of IC engines.

**CO3:** Evaluate the heat transfer coefficient using natural and forced convection apparatus.

**CO4:** Determine the flow rates and head losses in viscous and turbulent flows.

**CO5:** Evaluate the performance of hydraulic machinery such as pumps and turbines.

**List of Experiments:**

1. Valve timing and port timing diagrams for IC Engines.
2. Performance test on a Petrol Engine.
3. Performance test on a Diesel Engine.
4. Heat Balance test on an IC Engine.
5. Boiler – performance and Heat Balance Test.
6. Performance test on a Refrigerator (Determination of COP)
7. Determination of heat transfer Coefficient by Free convection
8. Determination of heat transfer Coefficient by Forced convection
9. Determination of coefficient discharge through venture meter
10. Test to estimate frictional losses in pipe flow.
11. Test on reaction turbine for obtaining the characteristics curves and to design values of specific speed, discharge, output and efficiency.
12. Test on impulse turbine to obtain its characteristics curves and hydraulic design values.

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| | |
|---|---|
| **Course Code:** 140EI0308 | **Course Title: ELECTRICAL MACHINES AND MEASUREMENTS LABORATORY** |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Determine the performance analysis of DC motors.

**CO2:** Analysis the performance of self and separately excited DC generator.

**CO3:** Predict the performance characteristics of Induction motor.

**CO4:** Calibration of Wattmeter, Energy meter, PT and CT to calculate error.

**CO5:** Analyze the performance of DC and AC bridges

**List of Experiments:**

**[A] ELECTRICAL MACHINES LABORATORY**

1. Open circuit and Load characteristics of Separately excited DC generator.
2. Open circuit and Load characteristics of self excited DC generator.
3. Load test on DC shunt motor and Series motor.
4. Speed control of DC motor.
5. Load test on single phase Induction motor.
6. Load test on three phase Induction motor.

**[B] MEASUREMENTS LABORATORY**

1. Calibration of Wattmeter and Energymeter.
2. Measurement of Resistance using Wheatstone's and Kelvin's double bridge.
3. Measurement of Resistance using Megger
4. Measurement of Reactive power, Power & Energy
5. Measurement of Inductance using Anderson's bridge.
6. Measurement of Capacitance using ScheringBridge.
7. Measurement of Current and Voltage using CT and PT.

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| Course Code: 140EI0309 | Course Title: ELECTRONIC CIRCUITS LABORATORY |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 0 : 0 : 3 : 2 : 100 |
| Type: Practical | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electron Devices

**Course Outcomes:**

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

**CO1.** Design various rectifiers and voltage regulators.

**CO2.** Design different diode application circuits.

**CO3**.Design and analyse various transistor biasing circuits.

**CO4**.Analyse the frequency response of Transistor based amplifiers.

**CO5**.Design and analyse different Oscillators using BJT.

**List of Experiments:**

1. Characteristics of Half-wave rectifier and Full wave rectifier with and without filters.
2. Characteristics of Bridge rectifier without & with filter
3. Clipper and Clamper Circuits.
4. Differentiator and Integrator
5. Series voltage regulator using Transistor.
6. Transistor biasing circuits for different quiescent operating point.
7. RC phase shift Oscillator.
8. Wien Bridge Oscillator.
9. Astable multivibrator.
10. Monostable multivibrator.
11. Class A Power Amplifier.
12. Class B complementary symmetry Power amplifier.

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**SEMESTER IV**

| | |
|---|---|
| **Course Code:** 140EI0401 | **Course Title: NUMERICAL METHODS** (Common to CE, ECE, EEE, EIE, ICE and IT Programmes) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1: 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Solve the system of linear and calculate dominant eigen values of a matrix.

**CO2:** Determine the solution for a nonlinear equation and Fit a curve to the given numerical data

**CO3:** Use numerical techniques to interpolate ,differentiate and integrate for the given numerical data

**CO4:** Solve the first and second order initial value problems

**CO5:** Solve the first and second order boundary value problems for the boundary value problems

**Course Content:**

**UNIT I SOLUTION OF SYSTEM OF LINEAR EQUATIONS 9+3**

Solution of linear system - Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method - Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence - Power method to find the dominant eigen value and eigen vector.

**UNIT II SOLUTION OF NON LINEAR EQUATIONS & CURVE FITTING 9+3**

Solution of nonlinear equation - Bisection method - Regulafalsi method - Newton- Raphson method - Order of convergence of these methods- Curve fitting - Method of least squares and group averages.

**UNIT - III INTERPOLATION & NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3**

Newton's forward, backward and divided difference interpolation – Lagrange's interpolation – Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 and 3/8 rules –Double integration-Trapezoidal rule.

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**UNIT - IV SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS** **9+3**

Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method of fourth order to solve first order differential equations- and second order equations – Multi step methods - Milne's and Adams' methods.

**UNIT -V SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS** **9+3**

Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation - Crank - Nicolson method - Solution of one dimensional wave equation.

**TEXT BOOKS:**


1. Sastry S.S. "Introductory methods of Numerical Analysis", 3rd edition, PHI, 2003.
2. Grewal, B.S. and Grewal, J. S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
3. SankaraRao, K. "Numerical methods for Scientists and Engineers", 3rd Edition Prentice Hall of India Private Ltd., New Delhi, 2007.


**REFERENCE BOOKS:**


1. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
2. Jain M. K., Iyengar, S. R. and Jain, R. K, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Company.


**WEB REFERENCE:**

1. https://www.math.ust.hk/~machas/numerical-methods.pdf
2. www.techmat.vgtu.lt/~inga/Files/Quarteroni-SkaitMetod.pdf
3. ns.sjtu.edu.cn/people/mtang/textbook.pdf

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| | |
|---|---|
| **Course Code:** 140EI0402 | **Course Title: LINEAR INTEGRATED CIRCUITS AND APPLICATIONS** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electron Devices
- 140EI0305 - Electronic Circuits

**Course Outcomes:**

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

**CO1.** Explain the IC fabrication process.

**CO2.** Design opamp based analog circuits..

**CO3.** Design the signal generators using Timer ICs.

**CO4**. Illustrate the internal functional blocks and the applications of special ICs like Timers, VCO, PLL circuits, regulator Circuits.

**CO5.** Design the signal condition circuits for different applications

**Course Content:**

**UNIT I IC FABRICATION 9**

IC classification, Fundamental of Monolithic IC technology, Basic Planar process: Epitaxial growth, Masking and Etching, Diffusion of impurities, Isolation techniques, Assembly processing and Packaging, Fabrication of IC based components: Active and Passive components, BJT, FET, MOSFET and CMOS – Fabrication of a typical circuit.

**UNIT II CHARACTERISTICS AND BASIC APPLICATIONS OF OPAMP 9**

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current, CMRR, Slew rate - Frequency response of OP-AMP - IC 741 - Inverting amplifier, Non Inverting amplifier, Summer, Differential amplifier, Average amplifier, Differentiator, Integrator and Log/Antilog amplifier.

**UNIT - III SPECIAL APPLICATIONS OF OPAMP 10**

Instrumentation amplifier, First and Second order active filters, V/I & I/V converters, Comparators, Multivibrators, Waveform generators, Clippers, Clampers, Peak detector, Precision rectifier - S/H circuit, D/A converter: R-2R ladder and Weighted resistor types - A/D converter : Dual slope, Successive approximation and Flash types.

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**UNIT - IV SPECIAL FUNCTION ICs** 9

555 Timer circuit – Functional block, characteristics & applications – 566 voltage controlled oscillator circuit – 565 Phase lock loop circuit functioning and applications, Analog multiplier ICs– IC voltage regulators: Fixed and Variable regulators – 78XX, 79XX, 317, 723 regulators, Switching regulator, Opto-Coupler ICs.

**UNIT -V CASE STUDIES – OPAMP BASED DESIGNS** 8

Design of Signal Conditioning circuits for Thermocouple, RTD, Strain gauge and LDR - Water level control - DC motor speed control.

**TEXT BOOKS:**


1. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003.
2. Roy Choudhary.D., Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. David A. Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 2005.


**REFERENCE BOOKS:**


1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2002.
3. S.Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd edition, Tata McGraw Hill, 2008


**WEB REFERENCE:**

1. https://www.nptel.ac.in/courses/Webcourse-contents/IIT ROORKEE/Analog%20circuits/index.htm
2. http://www.555-timer-circuits.com
3. http://www.technologystudent.com
4. http://freevideolectures.com/Course/2915/Linear-Integrated-Circuits#

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| | |
|---|---|
| **Course Code:** 140EI0403 | **Course Title: INDUSTRIAL INSTRUMENTATION – I** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0103 - Engineering Physics
- 140EI0303 - Transducer Engineering

**Course Outcomes:**

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

**CO1:** Explain the principle and working of force, torque and velocity measuring instruments.

**CO2:** Describe the different measuring methods of acceleration, vibration and density.

**CO3:** Summarize the various techniques for pressure measurement.

**CO4:** Illustrate the temperature standards, calibration and signal conditioning for temperature measuring instruments.

**CO5:** Select a suitable temperature measuring instruments for the given application.

**Course Content:**

**UNIT I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9**

Electric balance – Different types of load cells:- Hydraulic, Pneumatic strain gauge, Magneto elastic and Piezo electric load cell – Different methods of torque measurements:- strain gauge and Relative angular twist - Speed measurement:- Capacitive tacho, Dragcup type tacho, D.C. and A.C. Tachogenerators and Stroboscope.

**UNIT II MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9**

Accelerometers:- LVDT, Piezo-electric, Strain gauge and Variable reluctance type accelerometer – Mechanical type vibration instruments – Seismic instruments as an accelerometer – Vibrometers - Calibration of Vibration pickups - Units of density and specific gravity, Baume scale, and API scale – Density Measurement:- Pressure head type densitometers, Float type densitometers, Ultrasonic densitometer and Bridge type gas densitometer.

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**UNIT - III PRESSURE MEASUREMENT** 9

Units of pressure – Manometers – 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 and Resonator pressure sensor - Measurement of vacuum:- McLeod gauge, Thermal conductivity gauges and Ionization gauges:- Cold cathode type and hot cathode type - Testing and calibration of pressure gauges - Dead weight tester.

**UNIT - IV TEMPERATURE MEASUREMENT** 9

Definitions and standards - Primary and secondary fixed points –Calibration of thermometers - Different types of filled in system thermometers -Sources of errors in filled in systems and their compensation-Bimetallic thermometers – Electrical methods of temperature measurement-Signal conditioning of RTDs and their characteristics - 3 lead and 4 lead RTDs - Thermistors.

**UNIT -V THERMOCOUPLES AND RADIATION PYROMETERS** 9

Thermocouples - Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning - Isothermal block reference junctions – Cold junction compensation - High temperature Measurement – Radiation methods of temperature measurement – Radiation fundamentals - Total radiation pyrometers – Optical pyrometers - Two colour radiation pyrometers – Fiber Optic temperature measurement.

**TEXT BOOKS:**


1.Doebelin. E.O., 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2004.

2.Jain. R.K., 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi,1999.


**REFERENCE BOOKS:**


1.Patranabis.D., 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.

2.Sawhney.A.K. andSawhney.P., 'A Course on Mechanical Measurements, Instrumentation and Control', DhanpathRai and Co, 2004.

3.Nakra.B.C. &Chaudary.K.K., 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004.

4.Singh.S.K., 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.


**WEB REFERENCE:**

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/112106140

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| | |
|---|---|
| **Course Code:** 140EI0404 | **Course Title: COMMUNICATION ENGINEERING** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electronic Devices
- 140EI0305 - Electronic Circuits

**Course Outcomes:**

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

**CO 1**: Determine the frequency spectrum by computing modulation indices for analog communication systems

**CO 2:** Describe the different types of transmission lines and the basic idea of radio propagation.

**CO 3:** Explicate the different digital modulation schemes and the concept of Multiplexing.

**CO 4:** Elucidate the various satellite and data communication networks.

**CO 5:** Expound the fundamentals of communication systems and instrument interface as per IEEE standards

**Course Content:**

**UNIT I ANALOG MODULATION SYSTEMS** 9

Time and frequency domain representation of signals, electromagnetic spectrum, amplitude modulation (AM) and demodulation, frequency modulation(FM) and demodulation, Phase modulation(PM),super heterodyne receiver, AM transmitter.

**UNIT II TRANSMISSION MEDIUM** 9

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

**UNIT - III DIGITAL COMMUNICATION** 9

Pulse code modulation (PCM), time division multiplexing (TDM), frequency division multiplexing (FDM) digital T-carrier system. Digital radio system. Digital modulation: Frequency shift keying (FSK) – Modulator and demodulator, phase shift keying (PSK) – Modulator and demodulator.

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**UNIT - IV SATELLITE AND DATA COMMUNICATIONS 9**

Kepler's Three laws of Planetary motion ,Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations,Serial and Parallel communication: RS232, RS422, RS485,USB and Centronics.

**UNIT -V COMMUNICATION FOR INSTRUMENT INTERFACE 9**

GPIB, PCI, PXI, $I^2C$, SPI, CAN, MOD Bus,VME Bus, VXI bus characteristics and IEEE488 standards.

**TEXT BOOKS:**


1. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, Third Edition, 2001.
2. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002.


**REFERENCE BOOKS:**


1. John Park, Steve Mackay, 'Practical Data acquisition for Instrumentation and Control Systems', Newness Publications, 1st edition, 2003
2. John Park, Steve Mackay, Edwin Wright, 'Practical Data Communication for Instrumentation and Control', Newness Publications, 1st edition, 2003
3. Kennedy.G., 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.
4. Krishna Kant , 'Computer based Industrial Control', Prentice Hall of India, 1997.


**WEB REFERENCE:**

1. http://www.nptel.ac.in/courses/117102059/8
2. http://www.nptel.ac.in/courses/117101051/18
3. http://www.nptel.ac.in/courses/117101054/

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| | |
|---|---|
| **Course Code:** 140EI0405 | **Course Title: DIGITAL PRINCIPLES AND APPLICATIONS** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Basic math functions and equivalents.
- Need to have basic understanding of digital systems, logic gates, combinational and sequential logic

**Course Outcomes:**

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

**CO1.** Explain about basics of digital electronics.

**CO2.** Solve problems related to number systems and Boolean algebra.

**CO3.** Identify, analyze and design combinational circuits.

**CO4.** Design various synchronous and asynchronous sequential circuits.

**CO5.** Explain the internal circuitry and logic behind any digital system.

**Course Content:**

**UNIT I BOOLEAN ALGEBRA** 9

Binary Numbers- Number Base Conversion- Signed Binary Numbers- Definitions of Boolean Algebra- Basic Theorems- Boolean functions- Canonical and standard forms- Digital Logic Gates- Fan in, Fan out and Noise Margin. Combinational circuits- Analysis Procedure-Design Procedure- Gate Level minimization- Map Method-Tabulation Method – Don't care condition.

**UNIT II COMBINATIONAL LOGIC** 9

Combinational logic circuit using basic Gates- NAND and NOR Implementation- Adders/Subtractors- Decoder-Encoder-Multiplexer- Demultiplexer - Binary Multiplier, Magnitude Comparator, Decoders. Encoders.

**UNIT - III SYNCHRONOUS SEQUENTIAL LOGIC** 9

Flip flops SR, JK, T, D and Master slave – Characteristic and excitation tables and equations –Level and Edge Triggering –Realization of one flip flop using other flip flops – Analysis and design of sequential circuits with state diagram, State table, State minimization and State assignment- Introduction to Arithmetic State Machine and ASM Chart.

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**UNIT - IV COUNTERS AND ASYNCHRONOUS SEQUENTIAL LOGIC 9**

Ripple counters –Design of Synchronous counters, Ring counters and Sequence detector - Registers – shift registers- Universal shift register. Analysis of Asynchronous Sequential– primitive state / flow table – Minimization of primitive state table –state assignment – Excitation table - cycles – Races – Hazards: Static –Dynamic –Essential –Hazards elimination.

**UNIT -V APPLICATIONS 9**

Digital System Design Procedure - System Design: BCD to Seven Segment Code Converter - Running LED System - Timer using MSI circuits - Quiz First Press identifier – Pulse Width measurement Unit.

**TEXT BOOKS:**


1. Morris Mano.M., Digital Design, 4th EditionPearson Education Pvt. Ltd, 2008
2. Donald D. Givone, Digital Principles and Design, TMH, New Delhi, 2002


**REFERENCE BOOKS:**


1. Charles H.Roth. Fundamentals of Logic Design, Thomson Learning, 2003.
2. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 2nd ed., Vikas Publishing House Pvt. Ltd, New Delhi, 2004
3. John .M Yarbrough, Digital Logic Applications and Design, Thomson- Vikas Publishing house, New Delhi, 2002
4. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, New Delhi,2003


**WEB REFERENCE:**

1. www.nptel.ac.in/courses/

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| | |
|---|---|
| **Course Code:** 140EI0406 | **Course Title: DATA STRUCTURES AND ALGORITHMS USING C++** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1: 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0105 - C Programming

**Course Outcomes:**

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

**CO1:** Explain the working of various linear data structures

**CO2:** Summarize the concept of hashing and priority queue

**CO3:** Describe the working of various non linear data structures.

**CO4:** Illustrate different searching and sorting techniques with their efficiency.

**CO5:** Demonstrate different algorithm design techniques

**Course Content:**

**UNIT I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND LINEAR DATA STRUCTURES** **9+3**

Introduction – concepts of object oriented programming – ADTs – The List ADT (Array & Linked List Implementation) – The Stack ADT – Applications of Stack – The Queue ADT – Applications of Queue.

**UNIT II HASHING AND PRIORITY QUEUES** **8+3**

Hashing – Separate chaining – Open addressing – Rehashing and Extendible hashing – Heap – Binary Heap – Applications of Priority Queues (The Selection Problem & Event Simulations) – d –heaps – Binomial Queues.

**UNIT - III NON LINEAR DATA STRUCTURES** **10+3**

Trees – Binary trees – Binary Search Trees – AVL Trees. Graph – Definitions – Topological Sort – Shortest path algorithms (Dijkstra's Algorithm) – Minimum Spanning Trees (Prim's and Kruskal's Algorithm) – Introduction to NP Completeness.

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**UNIT - IV SEARCHING AND SORTING** **9+3**

Searching – Linear Search – Binary Search – Sorting – Insertion sort, Bubble sort, Shell sort, Heap sort, Merge sort, Quick sort and Bucket sort – External Sorting – running time analysis.

**UNIT -V ALGORITHM DESIGN TECHNIQUES** **9**

Greedy Algorithm (Knapsack Problem) – Divide and Conquer (Euclidean algorithm) – Dynamic programming (Traveling salesman problem) – Backtracking (Eight queens Problem) – Branch and Bound (Job Scheduling).

**TEXT BOOKS:**


1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd edition, Pearson Education Asia, 2007.


**REFERENCE BOOKS:**


1. Michael T. Goodrich, "Data Structures and Algorithm Analysis in C++", Wiley student edition,2007.
2. Sahni, "Data Structures Using C++", The McGrawHill, 2006.
3. Jean – Paul Tremblay & Paul G.Sorenson, "An Introduction to data structures with applications", Tata McGraw Hill edition, 2nd edition, 2002.
4. John R.Hubbard, "Schaum's outline of theory and problem of data structure with C++", McGrawHill, 2000.
5. BjarneStroustrup, "The C++ Programming Language", Addison Wesley, 2000.


**WEB REFERENCE:**

1. www.tutorialspoint.com/cplusplus/cpp_object_oriented.htm
2. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=106106127
3. http://www.cosc.canterbury.ac.nz/mukundan/dsal/appldsal.html
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html.
5. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

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|---|---|
| **Course Code:** 140EI0407 | **Course Title: INTEGRATED CIRCUITS LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electron Devices
- 140EI0305 - Electronic Circuits

**Course Outcomes:**

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

**CO1:** Verify logic gates and Implement of Boolean Functions using logic gates.

**CO2:** Implement combinational and sequential logic circuits.

**CO3:** Demonstrate applications of Op-Amp.

**CO4:** Implement multivibrators and frequency multiplier circuits

**CO5:** Simulate the analog and digital circuit using SPICE.

**List of Experiments:**

1. Verification of logic gates and Implementation of Boolean Functions using logic gates.
2. Design of Adder/ Subtractor circuits.
3. a. Design of Code converters
   b. Design of Encoders and Decoders
4. Design of Counters
5. Design of Shift Registers
6. Design of Multiplexer/ De-multiplexer
7. Application of Op-Amp
   a. Inverter, Non-Inverter, summer, subtrator and average amplifier
   b. Practical Integrator/Differentiator
8. Instrumentation Amplifier
9. Design of Astable and Monostablemultivibrator using Timer IC.
10. I/V Converter and V / I Converter
11. Frequency multiplication using PLL.
12. Simulation of digital & analog circuits using spice S/W.

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|---|---|
| **Course Code:** 140EI0408 | **Course Title: TRANSDUCER AND SIGNAL CONDITIONING LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0303 - Transducer Engineering

**Course Outcomes:**

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

**CO1:** Demonstrate the operating principle and working of different transducers used for physical quantity measurements.

**CO2:** Analyze the characteristics of Resistive, Inductive and capacitive transducer.

**CO3:** Analyze the characteristics of Piezoelectric and halleffect transducer.

**CO4:** Demonstrate the working of I/P, P/I converter and shaft angle encoder.

**CO5:** Design and develop the signal conditioning circuits for sensors

**List of Experiments:**

1. Loading effect of potentiometer.
2. Strain gauge & load cell characteristics.
3. Characteristics of Capacitive transducers.
4. a. Characteristics of Photoelectric tachometer
   b. Characteristics of Piezoelectric transducers.
5. Characteristics of Hall effect transducers.
6. Characteristics of LVDT.
7. a. Characteristics of thermocouple,
   b. Characteristics of thermistor
   c. Characteristics of LDR.
8. Step response characteristics of RTD and thermocouple
9. P/I and I/P converters
10. Digital transducer – shaft angle encoder.
11. Signal conditioning circuit for temperature sensor
12. Signal conditioning circuit for optical sensor

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|---|---|
| **Course Code:** 140EI0409 | **Course Title: DATA STRUCTURES AND ALGORITHMS AND OBJECT ORIENTED PROGRAMMING LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0105 - C Programming
- 140EI0304 - Object Oriented Programming Concepts

**Course Outcomes:**

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

**CO1:** Implement the concepts of arrays, lists stacks and queues

**CO2:** Implement of sorting techniques, multiple inheritence and function overloading

**CO3:** Implement of Virtual Functions

**CO4:** Interface using JAVA

**CO5:** Develop packages using Java

**List of Experiments:**

1. Array implementation of List Abstract Data Type (ADT)
2. Linked list implementation of List ADT
3. Array implementations Stack ADT
4. Linked list implementations Stack ADT
5. Array implementations Queue ADT
6. Linked list implementations Queue ADT
7. Implement Quick Sort & Merge sort
8. Implementation of Multiple Inheritance using C++
9. Implementation of Function overloading Using C++
10. Implementation of Virtual Functions
11. Use of interfaces in Java
12. Developing packages in Java

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## SEMESTER V

| Course Code:140EI0501 | Course Title: CONTROL ENGINEERING |
|---|---|
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:**60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0202 - Engineering Mathematics - II

**Course Outcomes:**

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

**CO1:** Deduce transfer functions, block diagrams and signal flow graphs for open loop and closed loop systems

**CO2:** Analyze time domain response of first order systems, second order systems and PID controllers

**CO3:** Determine the frequency response of open loop systems.

**CO4:** Identify the stability of open loop systems

**CO5:** Analyze continuous linear systems using state variable approach

**Course Content:**

**UNIT I SYSTEMS AND THEIR REPRESENTATION 12**

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

**UNIT II TIME RESPONSE 12**

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

**UNIT - III FREQUENCY RESPONSE 12**

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

**UNIT - IV STABILITY OF CONTROL SYSTEM 12**

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion –Root locus construction – Effect of pole, zero addition – Gain margin and phase margin –Nyquist stability criterion.

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**UNIT -V STATE VARIABLE ANALYSIS** **12**

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability.

**TEXT BOOKS:**


1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, "Automatic Control systems", Pearson Education, New Delhi, 2003.


**REFERENCE BOOKS:**


1. K. Ogata, 'Modern Control Engineering', 4 th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, "Control Systems Engineering", 4thEdition, John Wiley, New Delhi, 2007.
3. SamarajitGhosh, "Control systems", Pearson Education, New Delhi, 2004.
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.


**WEB REFERENCE:**

1. www. nptel.ac.in
2. http://sunzi.lib.hku.hk/ER/subject/hkul/6213/co/1
3. www.mathworks.com

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| | |
|---|---|
| **Course Code:** 140EI0502 | **Course Title: BIOMEDICAL ENGINEERING** (Common to EEE and EIE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0303 - Transducer Engineering

**Course Outcomes:**

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

**CO1:** Explain the human pshysiology and bio transducers

**CO2:** Compare and contrast the types of Electro Physiological Measurements.

**CO3:** Differentiate different non electrical parameter measurements on human body.

**CO4:** Explain the concept of modern methods of imaging techniques.

**CO5:** Explain the concept of medical assisting and therapeutic equipment

**Course Content:**

**UNIT I PHYSIOLOGY AND TRANSDUCERS** 9

Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – CNS – PNS – Nerve cell –Synapse – Cardio pulmonary system – Physiology of heart and lungs –Circulation and respiration – Transducers – Different types – Piezoelectric, ultrasonic, resistive, capacitive, inductive transducers – selection criteria.

**UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS** 9

Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – PCG – EEG – EMG – ERG – Lead systems and recording methods – Typical Waveforms.

**UNIT - III NON-ELECTRICAL PARAMETER MEASUREMENTS** 9

Measurement of blood pressure – Cardiac output – Cardiac rate – Heart sound –Respiratory rate – Gas volume –- pH of blood, ESR, GSR measurements – Plethysmography.

**UNIT - IV MEDICAL IMAGING AND PMS** 9

X-ray machine _ Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety.

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**UNIT -V ASSISTING AND THERAPEUTIC EQUIPMENTS** 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators –Diathermy – Heart – Lung machine – Audio meters – Dialyzers.

**TEXT BOOKS:**


1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.


**REFERENCE BOOKS:**


1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.


**WEB REFERENCE:**

1. http://www.mtu.edu/biomedical/research/biosensors/
2. http://www.eecs.umich.edu/courses/bme458/

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| Course Code:140EI0503 | Course Title: MODERN ELECTRONIC INSTRUMENTATION |
|---|---|
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0306 – Electrical Machines and Measurements

**Course Outcomes:**

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

**CO1:** Explain the concepts of various analog instruments.

**CO2:** .Explain the concept of digital measuring instruments.

**CO3:** Describe the concept of Oscilloscopes and wave analyzer.

**CO4:** Compare and contrast different Recorders and Display devices.

**CO5:** Develop fundamental programs in LabVIEW

**Course Content:**

**UNIT I** **ANALOG METERS** **9**

Electronic analog meters: DC and AC voltmeters - True R.M.S. voltmeters - A.C. current measurements - multimeters – component measuring instruments: Q-meter - vector impedance meter- power meter.

**UNIT II** **DIGITAL INSTRUMENTS** **9**

Digital voltmeters and multimeter –Digital phase meters – Digital tachometers – F/V and V/F conversion techniques – Digital frequency, period and time measurements – Low frequency measurements – Automatic time and frequency scaling – Sources of error – Noise – Inherent error in digital meters, hidden errors in conventional ac measurements – RMS detector in digital multimeters.

**UNIT - III** **OSCILLOSCOPE AND WAVE ANALYZER** **10**

Cathode Ray oscilloscopes - Typical measurements using CRO - CRT screen characteristics –CRO Circuits- CRO Triggering - special probes - high frequency considerations. Sampling oscilloscope - digital storage oscilloscope- Modes of operation-Acquisition Methods- DSO Applications-Wave analyzer -harmonic distortion analyzer- spectrum analyzer –Logic analyzer.

**UNIT - IV** **RECORDERS AND DISPLAY DEVICES** **9**

Recorders - moving coil, potentiometric, event recorders - X-Y plotters - U.V.recorders - Magnetic tape recorders, digital recorders- LED: Digital Alpha Numeric Displays – 7 Segment displays – Dot matrix displays - LCD Display: Alpha Numeric Displays.

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**UNIT -V** **VIRTUAL INSTRUMENTATION** **8**

Virtual and Conventional instruments – LabVIEW and its features – LabVIEW front Panel, Block diagram and basic palettes – SubVI creation with example – for, while loops, Case, Sequence, structures, graphs, arrays, clusters, Strings, File I / O – IVI – VISA – PCI – PXI.

**TEXT BOOKS:**


1. Cooper.W.D and Helfrick.A.D, Electronic Instrumentation and Measurement Techniques, Third Edition, Prentice-Hall of India, 1991.
2. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW' PHI Learning Private Limited, New Delhi, Second Printing, 2011.


**REFERENCE BOOKS:**


1. Bouwens.A.J, Digital Instrumentation, McGraw Hill, 1997.(2008 reprint)
2. Patranabis.D 'Principles of Electronic Instrumentation, PH1 Learning Pvt Ltd, 2008.
3. Course in Electrical & Electronics Measurement &Instrumentation by SawhneyAk, DhanpatRai& Co P Ltd, 2012
4. Sanjay Gupta, Joseph John, 'Virtual Instrumentation using LabVIEW' Tata McGraw Hill, 5th Reprint, 2010


**WEB REFERENCE:**

1. http://iitg.vlab.co.in/?sub=61&brch=174
2. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20Measurements.htm

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| | |
|---|---|
| **Course Code:** 140EI0504 | **Course Title: INDUSTRIAL INSTRUMENTATION – II** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0103 - Engineering physics
- 140CO0203 - Material science
- 140EI0303 - Transducer Engineering

**Course Outcomes:**

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

**CO1:** Explain the various level measurement techniques adopted in industries

**CO2:** Compare and contrast the different types of mechanical flow meters and their installation

**CO3:** Describe the area flow meters, mass flow meters and electrical type flow meters

**CO4:** Select the suitable flow meters for various applications

**CO5:** Elucidate the viscosity, humidity and moisture measurements

**Course Content:**

**UNIT I LEVEL MEASUREMENT 9**

Gauge glass techniques coupled with photoelectric readout system – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube. Boiler drum level measurement – Differential pressure method – Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation, RADAR and ultrasonic sensors.

**UNIT II VARIABLE HEAD TYPE FLOW METERS 8**

Units and terms - Theory of fixed restriction variable head type flow meters – Orifice plate – Venturi tube – Flow nozzle – Dall tube – installation of head flow meters –5 valve way Manifolds– Piping arrangement for different fluids – Pitot tube.

**UNIT - III QUANTITY METERS, AREA FLOW METERS AND MASS FLOW METERS 10**

Positive displacement flow meters – Constructional details and theory of operation of mutating disc, reciprocating piston, oval gear and helix type flow meters – Inferential meter – Turbine flow meter – Rotameter – Theory and installation – Angular momentum mass flow meter – Coriolis mass flow

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meters – Thermal mass flow meters – Volume flow meter plus density measurement – Calibration of flow meters – Dynamic weighing method.

**UNIT - IV ELECTRICAL TYPE FLOW METER** 9

Principle and constructional details of electromagnetic flow meter – Different types of excitation schemes used – Different types of ultrasonic flow meters – Laser doppler anemometer systems – Vortex shedding flow meter – Target flow meter – Solid flow rate measurement – Guidelines for selection of flow meter.

**UNIT -V MEASUREMENT OF HUMIDITY AND MOISTURE** 9

Viscosity – units – terms – Say bolt viscometer – Rotameter type viscometer Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Electrolysis type hygrometer – Commercial type dew point meter – Moisture terms – Different methods of moisture measurement – Moisture measurement in granular materials, solid penetrable materials like wood, web type material.

**TEXT BOOKS:**


1. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill, New Delhi, 2004.
2. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna publishers, New Delhi, 2008.


**REFERENCE BOOKS:**


1. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurement, Instrumentation and Control', DhanpatRai and Co, 2004.
2. D.P.Eckman, 'Industrial Instrumentation', Wiley Eastern Limited, 2005.
3. Alan S. Morris, 'Principles of Measurement and Instrumentation', Prentice Hall of India, 2003.
4. B.C. Nakra and K.K. Chaudry, 'Instrumentation, Measurement and Analysis', Tata McGraw Hill, 2004.
5. B.G.Liptak, 'Instrument Engineers Hand Book (Measurement)', Chilton Book Co., 1994.


**WEB REFERENCE:**

1. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
2. http://www.pacontrol.com/industrial-instrumentation.html
3. http://www.endress.com/en/Field-instruments-overview

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|---|---|
| **Course Code:** 140EI0505 | **Course Title: MICROPROCESSORS AND MICROCONTROLLERS** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0 : 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 11EI401 - Linear Integrated Circuits and Applications
- 11EI404 – Digital Principles and Applications

**Course Outcomes:**

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

**CO1:** Summarize the architecture of 8085 and 8086 processors

**CO2:** Write assembly language programs for 8085 microprocessor

**CO3:** Explain the function of interfacing devices used with 8085 microprocessor

**CO4:** Describe the 8051 microcontroller and its associated devices

**CO5:** Illustrate the architecture of PIC microcontroller and applications of 8051

**Course Content:**

**UNIT I INTRODUCTION** **9**

8085: Architecture - Signals– Memory interfacing – I/O Devices Interfacing – Timing Diagram – Interrupt structure, 8086 Architecture.

**UNIT II PROGRAMMING OF 8085 PROCESSOR** **9**

Addressing modes and Instruction sets – Assembly language format – Data transfer, data Manipulation & control instructions – Programming: Loop structure with counting & Indexing - Subroutine instructions stack-Code Conversions.

**UNIT - III PERIPHERAL INTERFACING** **9**

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter – Interfacing with 8085 - A/D and D/A converter interfacing.

**UNIT - IV MICRO CONTROLLER 8051** **9**

Architecture - Addressing modes and Instruction Sets – Interrupt structure – Timer –I/O ports – Serial communication, Simple programming.

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**UNIT -V INTRODUCTION TO ADVANCED PROCESSORS & APPLICATIONS OF 8051** 9

Interfacing: LCD, ADC, DAC, Sensors, Stepper Motor, Keyboard and DC motor speed control. PIC microcontroller-CPU Architecture and instruction set.

**TEXT BOOKS:**

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi.

2. Kenneth J Ayala, 'The 8051 Micro controller', Thomson Delmer Learning, 2004

3. Microcontrollers, Principles and Applications – Ajit pal – PHI Ltd., - 2011.

**REFERENCE BOOKS:**

1. A.K. Ray and K.M. Bhurchandi, 'Advanced Microprocessors and peripherals', 2nd Edition,Tata McGraw-Hill, 2006.

2. Muhammad Ali Mazidi& Janice GilliMazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 2007.

3. John B.Peatman, 'Design with PIC microcontrollers', Pearson Education, New delhi.

**WEB REFERENCE:**

1. http://www.nptel.ac.in/downloads/106108100/

2.http://www.ustudy.in/ece/mpmc/u1

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| | |
|---|---|
| **Course Code:** 140EI0506 | **Course Title: POWER ELECTRONICS** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1 : 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0206 - Electron Devices

**Course Outcomes:**

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

**CO 1**: Classify the characteristics of various power semiconductor devices.

**CO 2:** Analyze and design the AC/DC rectifier circuits.

**CO 3:** Illustrate the different topologies of DC/DC converter circuits

**CO 4:**Compare and contrast the different PWM techniques of Inverter circuits

**CO 5:** Demonstrate the basic concepts in AC/AC converter circuits.

**Course Content:**

**UNIT I** **POWER SEMI-CONDUCTOR DEVICES** **12**

Introduction -Power Diode:V-I characteristics, reverse recovery characteristics and types – Thyristor family (SCR, TRIAC and GTO): Basic structure, static and dynamic characteristics, device specifications and ratings, methods of turn-on and turn-off - gate triggering circuit using UJT, commutation circuits, series and parallel connections and protection circuits – Power Transistors: Basic structure, static and dynamic characteristics of Power MOSFET and Power IGBT.

**UNIT II** **AC-DC CONVERTERS** **15**

Single Phase: Principle of phase angle control, Half wave rectifier with R and RL loads, function of freewheeling diode, semi-converter (Asymmetrical and Symmetrical configurations), Fully controlled converter with R and RL loads, Estimation of average load voltage and rms load voltage, Performance parameters, single-phase dual converter and effect of source inductance, Simple Problems.

Three Phase: Operation of half wave converter, half controlled and fully controlled converters with R and RL loads, Estimation of average load voltage, Simple Problems.

**UNIT - III** **DC-DC CONVERTERS** **12**

Choppers: Step-down and step-up chopper, Forced commutation techniques, Time ratio control and current limit control - Simple Problems.

Switching regulators: Principle of operation of Buck regulator, Boost regulator and Buck-boost

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regulators, SMPS - Simple Problems.

**UNIT - IV** **DC-AC CONVERTER** **12**

Types – Single phase and three phase bridge inverters: basic circuit and operation, Voltage control of single-phase inverters – Control of AC output voltage - Harmonic reduction. – HVDC SYSTEMS – UPS.

**UNIT -V** **AC-AC CONVERTER** **9**

Single phase and three phase AC voltage controllers: Basic circuit operation, sequence control and multi stage sequence control – Cycloconverter: single phase and three phase cycloconverters – Matrix converters – Applications: Tap changing transformers, AC circuit breakers.

**TEXT BOOKS::**


1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, 3rd Edition, 2011.
2. M.D.Singh and K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, New Delhi, 2006.
3. Bimal K Bose, "Modern Power Electronics& AC Drives",Phi Learning PVT. LTD New Delhi, 2002.


**REFERENCE BOOKS:**


1. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", 3rd Edition, John wiley and Sons, 2006.
2. Joseph Vithayathil, "Power Electronics: Principles and applications", Tata McGraw-Hill, New Delhi,2010.
3. Lander : Power Electronics, 3rd Edition, Tata McGraw Hills Publishing Company Limited, New Delhi 1994.


**WEB REFERENCE:**

1. http://www.nptel.ac.in/courses
2. https://www.rose-hulman.edu
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007/download-course-materials/

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| | |
|---|---|
| **Course Code:** 140EI0507 | **Course Title: MICROPROCESSORS AND MICROCONTROLLERS LABORATORY** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0405 - Digital Principles and Applications

**Course Outcomes:**

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

**CO1:** Apply the fundamentals of assembly level programming (ALP) of basic microprocessors and microcontrollers

**CO2**: Develop ALP for 8085/8086/8051

**CO3:** Interface with standard microprocessor interfaces including serial ports, digital-to-analog converters and analog-to-digital converters.

**CO4:** Interface the peripheral like DC motor and traffic light system with microprocessors or microcontroller

**CO5:** Analyze problems and apply a combination of hardware and software to address problem by programming.

**List of Experiments:**

1. Programming for 8/16 bit Arithmetic operations Using 8085
   Addition / subtraction / multiplication / division.
2. Programming with control instructions Using 8085
   Ascending / Descending order.
   Maximum / Minimum of numbers.
   ASCII / BCD code conversions.
3. Programming for Arithmetic operations Using 8086
   Addition / subtraction / multiplication / division.
4. A/D Interfacing.
5. D/A Interfacing.
6. Traffic light controller using 8085/8051.
7. Interfacing experiments using 8251, 8254.
8. Programming for 8/16 bit Arithmetic operations Using 8051
   Addition / subtraction / multiplication / division.
9. Interfacing and Programming of Servo Motor Speed control using 8051.

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10. Interfacing and Programming of Stepper Motor control using 8085/8051.
11. Interfacing and Programming of LCD Using 8051.
12. Keyboard / Display Interface using 8279.

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|---|---|
| **Course Code:** 140EI0508 | **Course Title: INDUSTRIAL INSTRUMENTATION LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0303 - Transducer Engineering
- 140EI0403 - Industrial Instrumentation I

**Course Outcomes:**

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

**CO1:** Calibrate the Pressure gauge using dead weight tester

**CO2:** Determine the discharge coefficient of given head type flow meter by suitable procedure.

**CO3:** Measurement of liquid level, viscosity and torque.

**CO4:** Calibrate and identify the error present in the temperature sensor, flow transmitter and pressure transmitter.

**CO5:** Measure the absorbance and pH of a sample solutions

**List of Experiments:**

1. Measurement of flow using Venturi meter and Orifice meter.
2. Calibration of Pressure gauge using dead weight tester.
3. Calibration of Temperature sensor (RTD).
4. Torque measurement in circular shaft using strain gauge.
5. Viscosity measurement of liquids using saybolt viscometer.
6. Level measurement using D/P Transmitter.
7. Measurement of absorbance of a sample using UV – Visible spectrophotometer.
8. pH meter standardization and measurement of pH values of solutions.
9. Measurement of liquid level using displacer torque tube.
10. Calibration of flow transmitter (Wheel flow meter).
11. Calibration of Pressure Transmitter.
12. Vibration measurement.

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|---|---|
| **Course Code:** 140EI0509 | **Course Title: SYSTEM SIMULATION AND VIRTUAL INSTRUMENTATION LABORATORY** |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Analyze the performance characteristics of DC motor and AC servo motor.

**CO2:** Model and predict the linear system using MATLAB.

**CO3:** Determine the Stability analysis of Linear Time Invariant system using MATLAB

**CO4:** Create a simple programming in VI using LabVIEW

**CO5:** Create a program in VI to interface with DAQ card using LabVIEW

**List of Experiments:**

1. DC speed control system.
2. Transfer function of DC motor
3. Characteristics of AC servo motor
4. Linear system analysis (Time domain analysis, Error analysis) using MATLAB.
5. Stability analysis (Bode, Root Locus) of Linear Time Invariant system using MATLAB
6. Stability analysis (Nyquist) of Linear Time Invariant system using MATLAB
7. Creating simple VIs, Editing, Debugging and SubVI
8. Creating Array manipulation using FOR loop
9. Timed WHILE loop configuration
10. Waveform Chart and graph operations with interfacing conventional Instruments
11. Temperature signal interface using USB 6009
12. CRO and Function generator interface using M Series DAQ card.

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## SEMESTER VI

| | |
|---|---|
| **Course Code:** 140EI0601 | **Course Title: EMBEDDED SYSTEM DESIGN** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0505 - Microprocessors and Microcontrollers

**Course Outcomes:**

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

**CO1:** Explain the basic functions, components and importance of Embedded systems

**CO2:** Describe the Features of PIC controller for real time applications

**CO3:** Develop the Real Time Models based with application examples

**CO4:** Elaborate the functions of RTOS

**CO5:** Select hardware and software models based on case study for applications such as smart card, digital camera, automatic chocolate vending machine and cruise car control

**Course Content:**

**UNIT I INTRODUCTION** 9

Embedded System – Classification of Embedded System – Processors in the embedded system – Processor and Memory organization – DMA – Timer and Counting devices – Device drivers and interrupt service mechanism.

**UNIT II PIC CONTROLLER** 9

PIC 16F8XX – Pin diagram – Registers – Program and Data Memory– I/O Ports – Serial Port expansion – SPI and I2C – Timers – ADC – Interrupts.

**UNIT - III REAL TIME MODELS** 9

State Machine and Concurrent Process model: Types of models – FSM – HCFSM and State chart Language – Program state machine model – Concurrent Process – communication among process – Synchronization among process – Data flow model.

**UNIT - IV REAL TIME OPERATING SYSTEMS** 9

RTOS - Real time kernel, OS tasks, task states, task scheduling, interrupt processing, Clocking, communication and synchronization, control blocks, memory requirements and control, kernel services.

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**UNIT -V CASE STUDIES** 9

Case Studies of Embedded System Design – Automatic Chocolate Vending machine – Digital Camera –Adaptive Cruise Control System in a Car – Smart Card.

**TEXT BOOKS:**


1. RajKamal, "Embedded Systems Architecture, Programming and Design", Tata McGrawhill Publishing Company Ltd, Second Edition, 2008
2. John.B.Peatman, "Design with Microcontrollers", Pearson Education, 2002


**REFERENCE BOOKS:**


1. Frank Vahid, Tony Givargis, "Embedded Systems Design", Wiley India, 2006
2. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2005.
3. Tim Wilhurst, "An Introduction to the Design of Small Scale Embedded Systems, Palgrave, 2004
4. Ajay V. Deshmukh, "Microcontrollers Theory and Applications", Tata McGraw Hill Publishing Company Ltd, 2008


**WEB REFERENCE:**

1. http://www.nptel.ac.in/courses
2. https://www.edx.org/course/embedded-systems-shape-world
3. http://www.barrgroup.com/Embedded-Systems/Books

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| | |
|---|---|
| **Course Code:** 140EI0602 | **Course Title: PRINCIPLES OF DIGITAL SIGNAL PROCESSING** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 1: 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours: 60** |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0301 - Engineering Mathematics – III

**Course Outcomes:**

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

**CO1:** Classify signals and systems with their mathematical representations

**CO2:** Analyze discrete time systems using Z- transform and Fourier transform.

**CO3:** Differentiate various discrete transformation techniques by applying computation methods such as DIT-FFT and DIF-FFT

**CO4:** Realize digital filters from analog filters using various transformation techniques

**CO5:** Explain about programmable digital signal processors.

**Course Content:**

**UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 12**

Need and benefits of Digital Signal Processing - 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 - Typical signal processing operations: convolution, correlation and transformation - Analog to Digital conversion of signals - sampling, signal reconstruction, signal quantization and encoding.

**UNIT II DISCRETE TIME SYSTEM ANALYSIS 12**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z transform - application to discrete systems - Stability analysis, frequency response – Fourier transform of discrete sequence – Discrete Fourier series– Convolution using Z-transform and Fourier transform.

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**UNIT - III DISCRETE TRANSFORMS 12**

DFT – Definition - properties, Computation of DFT using FFT algorithm – DIT & DIF -FFT using radix 2 – Butterfly structure; Computation of IDFT using DFT.

**UNIT - IV DESIGN OF DIGITAL FILTERS 12**

IIR design: Approximation of analog filter design - Butterworth and Chebyshev; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. FIR & IIR filter realization – Parallel & cascade forms.

**UNIT -V PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 12**

Introduction to programmable DSP's – An overview of TMS320F281X – TMS320F281XAssembly Language Instructions – Application programs in TMS320F281X.

**TEXT BOOKS:**


1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 4th Edition2007.
2. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture,Programming and Applications', Tata McGraw Hill, New Delhi, 2002.


**REFERENCE BOOKS:**


1. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi,III edition,2008.
2. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill, New Delhi,second edition,2010.
3. www.ti.com/ TMS320F281X data sheet.


**WEB REFERENCE:**

1. http://www.nptel.ac.in/courses

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| | |
|---|---|
| **Course Code:** 140EI0603 | **Course Title: PROCESS CONTROL** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0501 - Control Engineering

**Course Outcomes:**

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

**CO1:** Derive the mathematical modeling of first order, second order, interacting and non-interacting systems

**CO2:** Explain the principle and operation of final control elements, converters and actuators

**CO3:** Design PID controllers using Cohen-cohn and Ziegler Nichol's tuning methods by understanding controller characteristics and performance criteria

**CO4:** Describe different control schemes used in process control applications

**CO5:** Summarize the dynamic behavior and control schemes for distillation column, heat exchanger and chemical reactor

**Course Content:**

**UNIT I MATHEMATICAL MODELING OF PROCESSES 9**

Introduction of process control – Degrees of Freedom - Dynamic behavior of first-and second-order systems. Mathematical models for process dynamic behavior -Mathematical model of first order liquid level and thermal processes – Higher order process – Process with dead time- Interacting and non-interacting systems – Continuous and batch process – Servo and regulatory operation.

**UNIT II FINAL CONTROL ELEMENT 9**

I/P Converter– Types of actuators – Pneumatic Control valves parts and its operation - Control valves characteristics – Classification of control valves – Types - Control valve sizing – Valve positioner - Cavitations and flashing – Selection of control valves.

**UNIT - III CONTROLLER CHARACTERISTICS AND TUNING 9**

Basic control action – Discontinuous and Continuous controller modes – Composite controllers PI, PD and PID – Electronic controllers to realize various control actions – Performance criteria – IAE, ISE, ITAE and ¼ decay ratio – Tuning of controllers – Ziegler-Nichol's method and Cohen-Coon method.

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**UNIT - IV CONTROL SYSTEMS WITH MULTIPLE LOOPS 9**

Multivariable control loops - Cascade control – Feed forward control – Ratio control – Selective control systems – Split range control – internal Model control - Adaptive and inferential control – Model Predictive control.

**UNIT -V DYNAMICS AND CONTROL–CASE STUDY 9**

Dynamics and control of Heat exchanger – Dynamics and control of Distillation process - Dynamics and control of chemical reactors.

**TEXT BOOKS:**


1. G. Stephanopoulos, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.
2. 2. Donald R. Coughanowr, 'Process Systems Analysis and Control' McGraw hill International edition, 2005.


**REFERENCE BOOKS:**


1. Bela.G.Liptak, 'Process Control', Chilton Book Company, 1994.
2. Curtis D. Johnson, 'Process Control Instrumentation Technology', 7th Edition, Pearson Education, New Delhi, 2002 / PHI.
3. B.WayneBequette, 'Process Control: Modelling, Design and Simulation', Prentice hall professionals, 2003.
4. K. Krishnaswamy, 'Process control', New Age International 2008.
5. Donald P. Eckman, 'Automatic Process Control', Wiley Eastern Ltd., New Delhi, 1993.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI0604 | **Course Title: VLSI DESIGN** (Common to EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0405 -Digital Principles and Applications

**Course Outcomes:**

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

**CO1:** Describe the MOS transistors and circuit layout in static CMOS logic style.

**CO2:** Identify the characteristics of MOS inverters and estimate power consumption of a VLSI chip.

**CO3:** Construct layouts for the logic circuit incorporating technology-specific layout rules.

**CO4:** Extract analog parasitic elements from the layout and explain the chip technology scaling process.

**CO5:** Design elementary data paths for microprocessors viz., moderate-speed adders, Subtractors and multipliers.

**Course Content:**

**UNIT I MOS TRANSISTOR THEORY** 9

VLSI Design Flow- Basic MOS Transistors – NMOS, CMOS Fabrication- MOS Transistor Operation- Threshold Voltage-Derivation of Drain Current- Channel length modulation- Body Effect-Transconductance-DC model of MOS transistor.

**UNIT II INVERTERS** 9

NMOS Inverter- Resistive Load Inverter Circuit- NMOS Inverter with Depletion NMOS as a Load-CMOS Inverter- Latch-up in CMOS Circuit- CMOS Transmission Gate- Tristate Inverter- Power Dissipation in CMOS Circuits.

**UNIT - III LOGIC DESIGN WITH MOSFETS** 9

MOSFETS as Switches- Basic Logic Gates in CMOS:NOT-NOR-NAND and other Complex gates-MOS Layers- Stick diagram- Design Rules and Layout Diagram- Physical design of Simple Logic Gates.

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**UNIT - IV BASIC CIRCUIT CONCEPTS** 9

Sheet Resistance- Capacitance Calculation- Delay Unit τ- Driving Large Capacitive Loads- Propagation Delays- Wiring Capacitances- Scaling of MOS circuits.

**UNIT -V SUBSYSTEM DESIGN** 9

Introduction- Design of ALU – Design of Adders: Parallel Adder-Manchester Carry Chain Adder- Carry Skip Adder- Carry Select Adder-Carry Look Ahead adder- Design of Multipliers: array Multiplier-Serial Parallel Multiplier-Baugh wooly multiplier- Booth Multiplier- FPGA: Architecture and Programming Technologies.

**TEXT BOOKS:**

1. Kiran Kumar VG and Nagesh, "Fundamentals of CMOS VLSI Design", Pearson Education, 2nd Edition, 2012.

**REFERENCE BOOKS:**

1. Neil Weste and David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, third edition, Addison Wesley, 2005.
2. Weste& Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed, Addison Wesley, 2005.

**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI0607 | **Course Title: PROCESS CONTROL LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0408 - Transducer and Signal Conditioning Laboratory
- 140EI0508 - Industrial Instrumentation Laboratory
- 140EI0509 - System Simulation / Virtual Instrumentation Laboratory

**Course Outcomes:**

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

**CO1:** Demonstrate the dynamic behavior of the processes

**CO2:** Design and verify the PID controller for different order processes

**CO3:** Demonstrate the closed loop behavior of the flow, level, pressure and temperature processes

**CO4:** Determine characteristics of control valves

**CO5:** Demonstrate advanced control loops by using CSTR and distillation processes

**List of Experiments:**

1. Higher order systems - Interacting and non-interacting systems
2. Response of P+I+D controller using MATLAB
3. Design of Electronic PID Controller
4. PID Controller tuning with performance criteria using MATLAB
5. Closed loop response of flow control loop and characteristics of flow transmitter
6. Closed loop response of level control loop and characteristics of level transmitter
7. Closed loop response of temperature control loop
8. Closed loop response of pressure control loop and characteristics of pressure transmitter
9. Characteristics of control valve with and without positioner
10. Ratio and cascade complex control loop
11. Distillation temperature control using PID controller
12. Closed loop response of CSTR dynamics and control

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| Course Code:140EI0608 | Course Title: DIGITAL SIGNAL PROCESSING LABORATORY |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Practical | Total Contact Hours:45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0509 - System Simulation / Virtual Instrumentation Laboratory

**Course Outcomes:**

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

**CO1:** Generate various discrete time signals using MATLAB Software and analyse their behavior for different test conditions.

**CO2:** Perform linear and Circular Convolutions between discrete time signals using MATLAB Software as well as DSP Processor, TMS329C50.

**CO3:** Analyze signal reconstruction of band limited continuous time signals from its discrete time version based on sampling theorem using MATLAB Software.

**CO4:** Compute DFT of a discrete time sequence using MATLAB Software as well as DSP Processor, TMS329C50.

**CO5:** Design digital filters like FIR and IIR using MATLAB Software.

**List of Experiments:**

**USING TMS320C50/TMS320VC5416**

1. Generation of Signals
2. Implementation of Linear and Circular Convolution
3. Sampling of input signal and display
4. Implementation of FIR filter
5. Implementation of IIR filter

**USING MATLAB**

1. Generation of Signals
2. Linear and circular convolution of two sequences
3. Sampling and effect of aliasing
4. Design and Analysis of FIR filters using Windows
5. Design and Analysis of IIR filters using Windows
6. Calculation of FFT of a signal
7. Z Transform and Inverse Z Transform of a given transfer function

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| Course Code: 140EI0610 | Course Title: MINI PROJECT |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 0 : 0: 3 : 2 : 100 |
| Type: Practical | Total Contact Hours: 45 |

**Course Outcomes:**

**CO1:** Demonstrate the understanding of the engineering principles in multidisciplinary environment.

**CO2:** Communicate effectively with proper aids and documents.

**CO3:** Perform effectively as a member in a team to complete the project successfully.

**CO4:** Comply with code of conduct and professional ethics in developing and completing the project.

**CO5:** Develop project that give sustainable solutions within societal and environmental contexts for problems related to Electronics & Instrumentation Engineering.

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## SEMESTER VII

| | |
|---|---|
| **Course Code:** 140EI0701 | **Course Title: PRINCIPLES OF MANAGEMENT** (Common to ECE, EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Discuss and communicate the evolution of management thinking.

**CO2:** Explain the importance of planning and organizing.

**CO3:** Evaluate leadership styles to anticipate the consequences of each leadership style.

**CO4:** Analyze and formulate best control methods

**CO5:** Summarize the importance of Motivation, Globalization and Liberalization.

**Course Content:**

**UNIT I INTRODUCTION** **9**

Historical developments –approaches to management– Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organization.

**UNIT II MANAGERS AND ENVIRONMENT** **9**

Social responsibility–Planning – Objectives – Setting Objectives – Process of Managing through Objectives – Strategies- Policies & Planning Premises- Forecasting Techniques – Decision-making.

**UNIT - III FUNCTIONAL AREA OF ORGANISATION** **9**

Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process – Techniques.

**UNIT - IV MOTIVATION AND DIRECTIONS** **9**

Objectives– Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication-Types.

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**UNIT -V CONTROLLING STRATEGIES 9**

System and process of Controlling – Requirements for effective control – The Budget as Control Technique – Information Technology– Computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

**TEXT BOOKS:**


1. Harold Kooritz& Heinz Weihrich 'Essentials of Management', Tata McGraw- Hill-7th Edition-2007.
2. Tripathy PC And Reddy PN, 'Principles of Management', Tata McGraw-Hill 1999


**REFERENCE BOOKS:**


1. Joseph L Massie, 'Essentials of Management', Prentice Hall of India- (Pearson) 4th Edition-2003.
2. Decenzo David- Robbin Stephen. A, 'Personnel and Human Reasons Management', Prentice Hall of India- 1996.
3. Robbins, 'Principles of Management', Pearson education -2005


**WEB REFERENCE:**

1. http://www.nptel.ac.in/courses
2. https://www.edx.org/Principles+Of+Management

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| | |
|---|---|
| **Course Code:** 140EI0702 | **Course Title: LOGIC AND DISTRIBUTED CONTROL SYSTEM** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0405 - Digital Principles and Applications

**Course Outcomes:**

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

**CO1:** Paraphrase different digital controllers and SCADA systems

**CO2:** Develop ladder logic programs for elevator and boiler systems using PLC

**CO3:** Illustrate the open SCADA protocol for industrial applications

**CO4:** Explain the different architectures and functional elements in DCS

**CO5:** Describe the engineering and operator interfaces used in DCS

**Course Content:**

**UNIT I COMPUTER CONTROLLED SYSTEM 9**

Basic building blocks of computer control system – Data acquisition system – Direct digital control System – Supervisory Control- Evolution of PLC's – PLC Architecture –I/O Devices- Advantages over relay logic.

**UNIT II PLC PROGRAMMING 9**

PLC programming languages – Ladder diagram – Programming timers and counters – Instructions in PLC –Logical Instructions, Program control instructions, math instructions, sequencer instructions – Applications of PLC –Elevator System – Boiler Temperature and level control - Introduction to FBD.

**UNIT - III SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM 9**

SCADA: - Hardware and software, Remote terminal units, Master station, Communication architectures - open SCADA protocols – DNP3 and 60870 - Case Study: Water Industry Application of DNP3 and SCADA.

**UNIT - IV DISTRIBUTED CONTROL SYSTEM 9**

Evolution – Building blocks – Field controlled units – Operator stations – Data highways – Redundancy concepts – Communication in DCS – DCS system integration with PLC and computers.

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**UNIT -V INTERFACES IN DCS** **9**

Operator interfaces – Low and High level operator interfaces – operator displays – Engineering interfaces – Low and High level engineering interfaces.

**TEXT BOOKS:**


1. Frank D.Petruzella, 'Programmable Logic Controllers', Fourth edition, Tata McGraw Hill, 2010
2. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004
3. Michael P. Lukas, 'Distributed Control System', Van Nostrand Reinhold CO, Newyork, 1986.


**REFERENCE BOOKS:**


1. John W. Webb, Ronald A. Reis 'Programmable Logic Controllers and Applications', PHI Learning, Fifth Edition, 2009.
2. T. Hughes, 'Programmable Logic Controllers', ISA press, 4th edition, 2008.
3. S.K Singh, 'Computer Aided Process Control', Prentice Hall of India, 2005.
4. Krishna Kant, 'Computer based Industrial Control', Prentice Hall of India, Second Edition, 2010.


**WEB REFERENCE:**

1. http://nptel.ac.in/courses/108105062/
2. http://www.plcs.net/contents.shtml

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| | |
|---|---|
| **Course Code:** 140EI0703 | **Course Title: INSTRUMENTATION SYSTEM DESIGN** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0303 - Transducer Engineering
- 140EI0403 - Industrial Instrumentation – I
- 140EI0603 - Process Control

**Course Outcomes:**

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

**CO1:** Design the concepts of pressure and level measurement devices.

**CO2:** Construct the signal conditioning circuits using controller concept.

**CO3:** Predict the design of valves and study need of P&I diagrams

**CO4:** Design the concepts of Alarm and Annunciator circuits

**Course Content:**

**UNIT I DESIGN OF TRANSDUCERS** **9**

An overview of static and dynamic performance characteristics of instruments. Selection criteria for flow, temperature, level, and pressure transducers. Design considerations for transducers such as thermocouple, RTD, orifice plates, Calibration and installation procedure for thermocouple and RTD.

**UNIT II PRESSURE AND LEVEL** **9**

Design of Pressure Gauge, Bellows, Bourdon Tube, and Diaphragm based Pressure - Level Instrumentation Design – Design of Air purge system for level measurement.

**UNIT - III CONTROLLERS AND SIGNAL CONDITIONING** **9**

Electronic P+I+D controllers- design - adjustment of set point, bias and controller settings – Signal conditioning elements - Deflection Bridges, Amplifiers, AC. Carriers systems, Current Transmitters, Analog to Digital Conversion, Sampling.

**UNIT - IV CONTROL VALVES** **9**

Control valves - design of actuators and positioners - types of valve bodies- valve characteristics materials for body and trims- sizing of control valves , Piping and Instrumentation diagrams, ISA symbols, PI diagrams of typical process plants.

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**UNIT -V ALARMS AND ANNUNCIATORS** 9

Design of logic circuits for alarm and Annunciator circuits- Design of microprocessor based Instrumentation systems, design of interfacing circuits and data acquisition - microprocessor based P+I+D controller.

**TEXT BOOKS:**


1. D. M. Considine, Process/Industrial Instruments and Control Handbook, Fourth Edition, McGraw-Hill Inc.,2009.
2. C. D. Johnson, Process Control Instrumentation Technology, Fourth Edition, PHI, 2008.


**REFERENCE BOOKS:**


1. N. A. Anderson, Instrumentation for Process Measurement and control, Chilton Company, 2002.
2. J. P. Benley, Principles of Measurement Systems, Longman Inc., 2000.
3. Bela. G. Liptak, Instrument Engineers Handbook, Vol. I and II, Third Edition, Chilton and Book Company, 2006.
4. T. R. Padmanabhan, Industrial Instrumentation: Principles and Design, Springer Verlag Publications, 2000.


**WEB REFERENCE:**

1. nptel.ac.in/courses/112101096/
2. nptel.iitg.ernet.in/Courses(Video).php

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| Course Code:140EI0707 | Course Title: INDUSTRIAL AUTOMATION LABORATORY (Common to EIE and ICE) |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Practical | Total Contact Hours:45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0501 - Control Engineering

**Course Outcomes:**

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

**CO1:** Design digital control algorithms for the given process

**CO2:** Develop ladder logic for PLC

**CO3:** Demonstrate PLC based bottle filling system

**CO4:** Demonstrate PLC/NI ELVIS based closed loop control process for flow, level, pressure and thermal process

**CO5:** Demonstrate Human Machine Interfaces and DCS

**List of Experiments:**

1. Design of Discrete P+I+D controller for a Second order system
2. Design of dead beat / Dahlin algorithms.
3. Programming of Programmable logic controller.
4. Computer controlled liquid level system using PLC.
5. Computer controlled thermal system using PLC.
6. Control of Bottle filling system using PLC.
7. Closed loop response of level process
8. Closed loop response of Pressure process
9. Closed loop response of flow process
10. Closed loop response of Thermal process
11. Distributed Control System
12. HMI

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| | |
|---|---|
| **Course Code:** 140EI0708 | **Course Title: EMBEDDED SYSTEM DESIGN LABORATORY** (Common to EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : 2 : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO108 – C programming Laboratory
- 140EI0507 - Microprocessor and Microcontroller Laboratory

**Course Outcomes:**

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

**CO1:** Develop Embedded C Programming for Timers and RTC

**CO2:** Interface peripherals such as keypad and LCD for validating the key pressed and to for calculator designing

**CO3:** Interface sensor and voltmeter for monitoring

**CO4:** Interface peripherals such as DC motor and Zigbee with microcontroller using Embedded C programming

**CO5:** Design simple real time embedded systems using RTOS.

**List of Experiments:**

1. Activation of LED and Generating delay for buzzer using timer.
2. Interfacing of Matrix keyboard and display the data on LCD using microcontroller.
3. Display the IC based temperature sensor's signal on LCD using microcontroller
4. Design of Real Time Clock using microcontroller
5. Digital Voltmeter using microcontroller
6. Design of Calculator using microcontroller
7. Design of Digital PID controller using microcontroller
8. Control of DC motor via hyper terminal using microcontroller
9. Transmit and receive sensor data using RF communication
10. Round robin scheduling using RTOS
11. Cooperative scheduling using RTOS
12. Elevator Simulation by using RTOS

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| | |
|---|---|
| **Course Code:** 140EI0810 | **Course Title: PROJECT WORK (ANNUAL PATTERN)** |
| **Core/Elective:** Core | **L : T : P : C : M** – 0 : 0 : 3 : - : 100 |
| **Type:** Practical | **Total Contact Hours:** 45 |

**Course Outcomes:**

**CO1:** Demonstrate the understanding of the engineering principles in multidisciplinary environment.

**CO2:** Communicate effectively with proper aids and documents.

**CO3:** Perform effectively as a member in a team to complete the project successfully.

**CO4:** Comply with code of conduct and professional ethics in developing and completing the project.

**CO5:** Develop project that give sustainable solutions within societal and environmental contexts for problems related to Electronics & Instrumentation Engineering.

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## SEMESTER VIII

| | |
|---|---|
| **Course Code:** 140EI0801 | **Course Title: ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING** (Common to CSE, ECE, EEE, EIE and ICE) |
| **Core/Elective:** Core | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0701 - Principle of Management

**Course Outcomes:**

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

**CO 1:** Discuss about managerial economics and different elements of cost

**CO 2:** Describe about different market structures

**CO 3:** Identify the suitable cost estimation procedure

**CO 4:** Explain the types of costing methods

**CO 5:** Apply the knowledge on cost accounting

**Course Content:**

**UNIT I INTRODUCTION** **9**

Objectives of Managerial Economics, Firm, Cost Estimation, Costing, Cost Accounting, Factors Influencing Managerial Decisions & Theoretical Concepts, Classification and Elements of cost

**UNIT II PRODUCTION ANALYSIS AND PRICING** **9**

Production Function-Least Cost Combination of Inputs-Factor Productivities & Return to Scale-Determinants of Price-Pricing under different objectives and Market Structures-Price Discrimination & Pricing methods in practice

**UNIT - III ESTIMATION** **9**

Estimation of Material, Labor and Overhead Cost, Allocation of Overheads. Estimation for different types of jobs

**UNIT - IV COSTING** **9**

Job Costing - Operating Costing - Process Costing - Standard Costing (Variance Analysis)GDP

**UNIT -V ACCOUNTING** **9**

Balance Sheet - Profit & Loss Statement - Evaluation of Investment decisions – Average Rate of Return-Payback Period-Net Present Value & IRR

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**TEXT BOOKS:**

1. V.L.Mote, Samuel Paul &G.S.Gupta, Managerial Economics-Concepts & Cases, TMH, Co, NewDelhi, 1989
2. T.P.Banga&S.C.Sharma, Mechancial Estimating and Costing, Khanna Publishers, 1984

**REFERENCE BOOKS:**

1. James.C.Van Home, "Fundamentals of fincancial Management", PHI, NewDelhi, 2004.
2. Jawaharlal, Cost Accounting, Tata McGraw-Hill company, 1996
3. RamachandranAryasry&VV.Ramana Murthy, Engg Economics & FinancialAccounting, Tata McGraw-Hill company, NewDelhi, 2004

**WEB REFERENCE:**

1. www.nptel.ac.in

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| Course Code: 140EI0810 | Course Title: PROJECT WORK (ANNUAL PATTERN) |
|---|---|
| Core/Elective: Core | L : T : P : C : M – 0 : 0 : 12 : 8 : 200 |
| Type: Practical | Total Contact Hours: 180 |

**Course Outcomes:**

**CO1:** Demonstrate the understanding of the engineering principles in multidisciplinary environment.

**CO2:** Communicate effectively with proper aids and documents.

**CO3:** Perform effectively as a member in a team to complete the project successfully.

**CO4:** Comply with code of conduct and professional ethics in developing and completing the project.

**CO5:** Develop project that give sustainable solutions within societal and environmental contexts for problems related to Electronics & Instrumentation Engineering.

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## ELECTIVES

| Course Code:140EI9111 | Course Title: ASIC DESIGN |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours:45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0604 - VLSI Design

**Course Outcomes:**

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

**CO1:** Explain the VLSI design flow and characteristics of MOS transistors.

**CO2:** Explain the characteristics of static and dynamic CMOS design.

**CO3:** Describe the MOS transistor parasitic and its effect on circuit performance.

**CO4:** Demonstrate logic synthesis for basic datapath systems.

**CO5:** Demonstrate the steps in ASIC physical design flow.

**Course Content:**

**UNIT I VLSI DESIGN PROCESS** **9**

Types of ASICs - Design flow -VLSI Design Process – Architectural Design – Logical Design – Physical Design – Layout Styles –Full custom, Semicustom approaches. NMOS and PMOS transistors, Threshold voltage- Body effect- Design equations- Second order effects. MOS models and small signal AC characteristics. Basic CMOS technology.

**UNIT II INVERTERS AND LOGIC GATES** **9**

NMOS and CMOS Inverters, Stick diagram, Inverter ratio, DC and transient characteristics , switching times, Super buffers, Driving large capacitance loads, CMOS logic structures , Transmission gates, Static CMOS design, dynamic CMOS design.

**UNIT - III CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION** **9**

Résistance estimation. Capacitance estimation. MOS capacitor characteristics. Device capacitances. Diffusion capacitance. SPICE modeling of MOS capacitance. Routing capacitance. Distributed RC effects. Inductance. Switching characteristics. Rise time. Fall time. Delay time. Empirical delay models. Gate delays. CMOS gate transistor sizing. Power dissipation. Scaling of MOS transistor dimensions.

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**UNIT - IV LOGIC SYNTHESIS AND SIMULATION** 9

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

**UNIT -V PHYSICAL DESIGN** 9

System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC.

**TEXT BOOKS:**


1. Smith, M.J.S., "Application Specific Integrated Circuits", Addison –Wesley, New York, 1997
2. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000


**REFERENCE BOOKS:**


1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2002
2. Wayne Wolf "Modern VLSI Design System on chip. Pearson Education.2002
3. Jan M Rabaey, " Digital Integrated Circuits" Prentice Hall of India, 2002
4. FarzadNekoogar and FaranakNekoogar, "From ASICs to SOCs": A Practical Approach, Prentice Hall PTR, New Jersey, 2003


**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI9112 | **Course Title: DIGITAL IMAGE PROCESSING** (Common to EIE and ICE) |
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0602 - Principles of Digital Signal Processing

**Course Outcomes:**

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

**CO1:** Explain various digital image processing fundamentals like visual perception, colour models and 2-D quantization.

**CO2:** Compute various 2-D image transforms.

**CO3:** Validate different image enhancement and restoration techniques.

**CO4:** Apply various image segmentation and representation techniques.

**CO5:** Encode source signals using different coding techniques.

**Course Content:**

**UNIT I DIGITAL IMAGE FUNDAMENTALS** 9

Elements of digital image processing systems- Elements of visual perception- psycho visual model- brightness- contrast- hue- saturation- mach band effect- Color image fundamentals - RGB- HSI models- Image sampling- Quantization-Two dimensional mathematical preliminaries.

**UNIT II IMAGE TRANSFORMS** 9

1D DFT- 2D transforms – DFT- DCT- Discrete Sine, Walsh- Hadamard- KL transforms and their properties - Haar Wavelet Transform.

**UNIT - III IMAGE ENHANCEMENT AND RESTORATION** 9

Spatial domain enhancement: gray level transformations - histogram modification and specification techniques- Image averaging- Directional Smoothing- Median- Geometric mean- Harmonic mean- Contra harmonic and Yp mean filters. Image Restoration: degradation model- Unconstrained and Constrained restoration-Wiener filtering- Geometric transformations: spatial transformations- Gray-Level interpolation.

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**UNIT - IV IMAGE SEGMENTATION AND REPRESENTATION 9**

Point- line and edge detection- Edge linking- Region based segmentation: Region splitting and merging. Image representation: chain codes – polygonal approximations – signatures –boundary segments – skeletons.

**UNIT -V IMAGE COMPRESSION 9**

Need for data compression-Error free compression: variable length coding, bit plane coding, LZW coding. Lossy compression: Transform coding, wavelet coding. Overview of Compression standards: binary image compression standard, still image compression standards.

**TEXT BOOKS:**


1. Rafael C. Gonzalez and Richard E. Woods, 'Digital Image Processing', 2nd Edition, Pearson Education, 2008.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.


**REFERENCE BOOKS:**


1. Jayaraman, S., Essakirajan, S., and Veerakumar, T., 'Digital Image Processing', Tata McGraw Hill, New Delhi, 2010.
2. David Salomon, 'Data Compression – The Complete Reference', 3rd edition, Springer Verlag Newyork, 2006.
3. William K-Pratt, 'Digital Image Processing', 4th edition, John Wiley and Sons, 2007.
4. Kenneth R. Castleman, 'Digital Image Processing', Pearson Education, 1996.


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1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI9113 | **Course Title: ANALYTICAL INSTRUMENTATION** (Common to EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO0104 - Engineering Chemistry

**Course Outcomes:**

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

**CO1:** Explain the concepts and application of various spectrophotometers

**CO2:** Describe the different types of Nuclear radiation spectrometers

**CO3:** Contrast liquid and gas chromatography based on construction and working principle

**CO4:** Summarise the working and characteristics of different ion analyzers

**CO5:** Illustrate the measuring techniques for Pollutant gases from industries

**Course Content:**

**UNIT I COLORIMETRY AND SPECTROPHOTOMETRY 10**

Spectral methods of analysis – Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers.

**UNIT II SPECTROSCOPY 10**

Nuclear radiations, Detectors: GM counter – Proportional counter – Solid state detectors – Gamma cameras – Raman spectroscopy - X-ray spectroscopy – Detectors – Diffractometers – Absorption meters. NMR – Basic principles – NMR spectrometer - Applications. Mass spectrometers – Different types – Applications.

**UNIT - III CHROMATOGRAPHY 8**

Classifications – Gas chromatography - Sample Injection system– Detectors – Liquid chromatographs –High-pressure liquid chromatographs – Detectors –Applications.

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**UNIT - IV pH METERS AND DISSOLVED COMPONENT ANALYZERS 8**

Principle of pH measurement, reference electrodes, measuring electrodes: hydrogen electrodes, glass electrodes, selective ion electrodes, ammonia electrodes, conductivity meters - dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

**UNIT -V INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING 9**

Units and Industrial standards - Types of gas analyzers – Oxygen, $NO_2$ and $H_2S$ types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution – carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke density measurements.

**TEXT BOOKS:**


1. R.S. Khandpur, 'Handbook of Analytical Instruments', Tata McGraw Hill publishing Co. Ltd., 2009.
2. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, 'Instrumental Methods of Analysis', CBS publishing & distribution, 1995.


**REFERENCE BOOKS:**


1. Bela G. Liptak, 'Analytical Instrumentation', Chilton Book Company, United states, 2000.
2. Robert D. Braun, 'Introduction to Instrumental Analysis', McGraw Hill, Singapore, 1987.
3. G.W. Ewing, 'Instrumental Methods of Analysis', McGraw Hill, 1992.
4. D.A. Skoog and D.M. West, 'Principles of Instrumental Analysis', Holt, Saunders Publishing, 1985.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI9114 | **Course Title: AUTOMOBILE AND AIRCRAFT INSTRUMENTATION** (Common to EIE and ICE) |
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

2. 140EI0306 - Electrical Machines and Measurements
3. 140EI9113 - Analytical Instrumentation

**Course Outcomes:**

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

CO1:Contrast between different Automobile measuring devices

CO2:Summarize different sensors and actuators used in Automobiles

CO3: Explain the instruments used for emission Measurement

CO4:Describe on gyroscopic theory for aircraft

CO5:Recognize the Aircraft Navigation system

**Course Content:**

**UNIT I MEASURING DEVICES IN AUTOMOBILES 9**

Selection of measuring instrument, requirements of measurement such as precision, accuracy, errors, sensitivity, readability and reliability – Devices to measure temperature and pressure of the working fluid, coolant, air and fuel flow into the engine - Indicating and integrating instruments – Vibrometer, Accelerometer, vibration and pressure pickups, vibration test methods and counters.

**UNIT II SENSORS AND ACTUATORS 9**

Introduction to basic sensor arrangement – types of sensors – Oxygen sensors, crank angle position sensors – Fuel metering / vehicle speed sensor and detonation sensor – Altitude sensor – Flow sensors – Throttle position sensors – Solenoids, stepper motors, relays – Electronic dash board systems – GPS.

**UNIT - III INSTRUMENTATION FOR EMISSION MEASUREMENT 9**

Test procedures – NDIR analyzers – Flame ionization detectors – Chemiluminescent analyzers – Gas chromatograph – Smoke meters – Emission – Standards.

**UNIT - IV FLIGHT INSTRUMENTATION AND GYROSCOPIC INSTRUMENTS 9**

Classification of aircraft instruments – Instrument displays, panels, cockpit layout – Altimeters – Airspeed indicators – Machmeters – Accelerometers – Gyroscopic theory – Directional gyro indictor – Artificial horizon – Turn and slip indicators.

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**UNIT -V AIRCRAFT COMPUTER SYSTEMS 9**

Terrestial magnetism – Aircraft magnetism- Direct reading magnetic components – Compass errors – Gyromagnetic compass – Performance margin indicators – Safe take off indicators - Aircraft take off monitoring systems – Autopilot and navigation systems.

**TEXT BOOKS:**


1. Ribbens. B, 'Understanding Automotive Electronics', 5th Edition, Butterworth, Heinemann Woburn, 2012.
2. Robert C. Nelson, 'Flight stability and Automatic control', 2nd Edition, McGraw Hill International, 1998.


**REFERENCE BOOKS:**


1. Springer and Patterson, 'Engine Emission', Plenum Press, 1990.
2. Pallett E.H.J, 'Aircraft Instruments – Principles and Applications', Pitman and sons, 1981.


**WEB REFERENCE:**

1. https://www.araiindia.com/facilities_electronics.asp#8
2. https://www.eol.ucar.edu/aircraft-instrumentation

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| | |
|---|---|
| **Course Code:** 140EI9115 | **Course Title: FIBER OPTICS AND LASER INSTRUMENTS** (Common to EIE and ICE) |
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0203 - Material Science

**Course Outcomes:**

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

**CO1:** Apply the basic concepts of optical fibres and their properties.

**CO2:** Describe the Industrial applications of optical fibres.

**CO3:** Interpret the Laser fundamentals.

**CO4:** Explain the Industrial application of lasers

**CO5:** Illustrate the medical applications of Lasers.

**Course Content:**

**UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 12**

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

**UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9**

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

**UNIT - III LASER FUNDAMENTALS 9**

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

**UNIT - IV INDUSTRIAL APPLICATION OF LASERS 6**

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

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**UNIT -V MEDICAL APPLICATIONS OF LASER 9**

Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, Lasers in dentistry, Urology, Orthopedics, neurosurgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

**TEXT BOOKS:**


1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, Third Edition, 2009.
2. J. Wilson and J.F.B. Hawkes, 'Opto Electronics – An Introduction', Prentice Hall of India, 2001.


**REFERENCE BOOKS:**


1.Donald J.SterlingJr, 'Technicians Guide to Fibre Optics', Fourth Edition, Vikas Publishing House, 2004.

2.M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.

3.John F. Read, 'Industrial Applications of Lasers', Academic Press, 2000.

4.G. Keiser, 'Optical Fibre Communication', McGraw Hill, Fourth Edition, 2010.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI9116 | **Course Title: INSTRUMENTATION IN PETROCHEMICAL INDUSTRIES** (Common to EIE and ICE) |
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0403 - Industrial Instrumentation-I
- 140EI0504 - Industrial Instrumentation – II
- 140EI9113- Analytical Instrumentation

**Course Outcomes:**

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

**CO1:** Explain about the exploration, recovery, separation and refining of crude oil

**CO2:** Describe the production of petrol and its derivatives through different operations

**CO3:** Illustrate the methods to obtain the derivatives of methane, acetylene, ethylene and propylene

**CO4:** Select suitable measuring instruments for petroleum applications by ensuring intrinsic safety of instruments

**CO5:** Elaborate the various control loops used in Petrochemical Industry.

**Course Content:**

**UNIT I PETROLEUM PROCESSING** 7

Petroleum exploration – Recovery techniques – Oil – Gas separation - Processing wet gases – Refining of crude oil.

**UNIT II OPERATIONS IN PETROLEUM INDUSTRY** 10

Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerisation – Alkylation – Isomerization – Production of ethylene, acetylene and propylene from petroleum.

**UNIT - III CHEMICALS FROM PETROLEUM PRODUCTS** 10

Chemicals from petroleum – Methane derivatives – Acetylene derivatives – Ethylene derivatives – Propylene derivatives – Other products.

**UNIT - IV MEASUREMENTS IN PETROCHEMICAL INDUSTRY** 9

Parameters to be measured in refinery and petrochemical industry – Selection and maintenance of measuring instruments – Intrinsic safety of Instruments.

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**UNIT -V CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 9**

Process control in refinery and petrochemical industry – Control of distillation column – Control of catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of vinyl chloride and PVC production.

**TEXT BOOKS:**


1. A.L. Waddams, 'Chemicals from Petroleum', Butter and Janner Ltd., 1968.
2. J.G. Balchan. and K.I. Mumme, 'Process Control Structures and Applications', Van Nostrand Reinhold Company, New York, 1988.


**REFERENCE BOOKS:**


1.Austin G.T. Shreeves, 'Chemical Process Industries', McGraw Hill International Student edition, Singapore, 2012.

2.Bela.GLiptak, 'Instrumentation in Process Industries', Chilton Book Company, 1994.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| Course Code: 140EI9117 | Course Title: POWER PLANT INSTRUMENTATION (Common to EEE, EIE and ICE) |
|---|---|
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0403 - Industrial Instrumentation – I
- 140EI0504 - Industrial Instrumentation – II
- 140EI0603 - Process Control
- 140EI9113 - Analytical Instrumentation

**Course Outcomes:**

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

**CO1:** Explain overview of different methods of power generation and boiler process

**CO2:** Illustrate the various measurements involved in power generation plants.

**CO3:** Explicate the applications of analyser in power plant.

**CO4:** Apply the different control schemes for boiler control loops.

**CO5:** elucidate the methods of monitoring parameters of turbines and their control.

**Course Content:**

**UNIT I OVERVIEW OF POWER GENERATION 9**

Brief survey of methods of power generation – Hydro, Thermal, Nuclear, Solar and Wind power plants – Thermal power plants – Block diagram – Details of boiler accessories – P&I diagram of boiler – Cogeneration - Importance of instrumentation in power generation.

**UNIT II MEASUREMENTS IN POWER PLANTS 9**

Flow measurement of feed water, fuel, air and steam with correction factor for temperature – Measurement of steam temperature – Three elements Drum level measurement – Steam pressure measurement –Radiation measurement – Smoke and Dust Monitoring.

**UNIT - III ANALYSERS IN POWER PLANTS 9**

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography for gas analysis – pH meter – Fuel analyser – Pollution monitoring instruments.

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**UNIT - IV CONTROL LOOPS IN BOILER** 9

Combustion control – Air/Fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control - attemperator - Air temperature control - Deaerator control - Interlocks in boiler operation – Implementation using DCS.

**UNIT -V TURBINE AND CONDENSER – MONITORING AND CONTROL** 9

Speed, Vibration, Shell temperature Monitoring and Control – Steam pressure control – Lubricant oil temperature control – Cooling system. Condenser –Temperature monitoring – Reuse water control.

**TEXT BOOKS:**


1. Arora.S.C, Domkundwar.S, Domkundwar.A.V, A course in Power Plant Engineering, DhanpatRai& Co. (P) Ltd, Fifth revised and enlarged edition, 2006.
2. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.


**REFERENCE BOOKS:**


1.S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi, 1994.

2.R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.

3.E.Al. Wakil, 'Power Plant Engineering', Tata McGraw Hill, 1985.


**WEB REFERENCE:**

1. nptel.ac.in/courses/108106074/chapter1.pdf

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| Course Code: 140EI9118 | Course Title: SMART AND WIRELESS INSTRUMENTATION (Common to EIE and ICE) |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

1. 140EI0303 - Transducer Engineering
2. 140EI0404 - Communication Engineering

**Course Outcomes:**

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

**CO1:** Select the different types of sensors for wireless sensor networks

**CO2:** Design the wireless sensor nodes based on communicating device, Zigbee, ISA 100, Wireless HART

**CO3:** Select the suitable power harvesting devices for wireless sensor nodes

**CO4:** Develop the graphical user interface for receiving data

**CO5:** Discuss the hardware and algorithm based on case study for applications Physiological Parameters Monitoring System, Intelligent Sensing System for Emotion Recognition and Smart Power Monitoring System

**Course Content:**

**UNIT I SENSORS FUNDAMENTAL 9**

Sensor Classification-Thermal Sensors-Humidity Sensors-Capacitive Sensors-Planar Inter digital Sensors-Planar Electromagnetic Sensors-Light Sensing Technology-Moisture Sensing Technology-Carbon Dioxide (CO2) Sensing Technology-Sensors Parameters-TEDS.

**UNIT II WIRELESS SENSORS AND SENSORS NETWORK 9**

Frequency of Wireless Communication-Development of Wireless Sensor Network Based Project-Wireless Sensor Based on Microcontroller and Communicating Device-Zigbee Communicating Device - ISA 100 –Wireless HART.

**UNIT - III POWER SUPPLIES FOR SENSORS 9**

Power Sources-Energy Harvesting-Solar and Lead Acid Batteries-RF Energy Harvesting-Energy Harvesting from Vibration-Thermal Energy Harvesting-Energy Management Techniques-Calculation for Battery Selection.

**UNIT - IV SOFTWARE DESIGN FOR DATA RECEPTION AND ANALYSIS 9**

Brief Description of API Mode Data Transmission-Testing the Communication between Coordinator

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and Remote XBee-Design and Development of Graphical User Interface for Receiving Sensor Data Using C++.A Brief Review of Signal Processing Techniques for Structural Health Monitoring.

**UNIT -V WIRELESS SENSOR AND INSTRUMENT APPLICATIONS 9**

WSN Based Physiological Parameters Monitoring System-Intelligent Sensing System for Emotion Recognition-WSN Based Smart Power Monitoring System.

**TEXT BOOKS:**


1. Subhas Chandra Mukhopadhyay "Smart Sensors, Measurement and Instrumentation", Springer Heidelberg New York Dordrecht London,2013
2. HalitEren, "Wireless Sensors and Instruments: Networks, Design, and Applications", CRC Press, Taylor and Francis Group, 2006.


**REFERENCE BOOKS:**


1. UvaisQidwai "Smart Instrumentation: A Data Flow Approach to Interfacing" Chapman & Hall; 1 edition December 2013


**WEB REFERENCE:**

1. nptel.ac.in/courses/108105064/34

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| | |
|---|---|
| **Course Code:** 140EI9119 | **Course Title: ADVANCED PROCESS CONTROL** (Common to EIE and ICE) |
| **Core/Elective:** Elective | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0603 - Process Control

**Course Outcomes:**

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

**CO1:** Demonstrate control schemes for satisfying the process requirements

**CO2:** Determine system behavior by time and frequency analysis

**CO3:** Design advanced controllers based on process model

**CO4:** Analyse the multivariable control systems for sensitivity and operability

**CO5:** Demonstrate digital controllers dynamic response and stability

**Course Content:**

**UNIT I ADVANCED CONTROL STRATEGIES** **9**

Feed forward, cascade, dead time compensation, split range, selective and override control, adaptive control; automatic tuning and gain scheduling.

**UNIT II SYSTEM IDENTIFICATION** **9**

Non Parametric methods: - Transient analysis – Frequency analysis – correlation analysis– Spectral analysis – Parametric methods: - Least square method – Recursive least square Method.

**UNIT - III INTERNAL MODEL CONTROL** **9**

Model based control – IMC structure – development and design; IMC based PID control, Model Predictive Control.

**UNIT - IV MULTIVARIABLE CONTROL** **9**

Control loop interaction – general pairing problem, relative gain array and application, sensitivity. Multivariable control – zeros and performance limitations, directional sensitivity and operability, decoupling control.

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**UNIT -V DISCRETE SYSTEMS** 9

Z – Transform and inverse Z – transform properties, Discrete – Time Response of dynamic system, Pulse Transfer Function, Closed Loop System Stability.

**TEXT BOOKS:**


1. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.
2. Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005.
3. Bela.GLiptak "Instrument Engineers Handbook:Process Control and Optimization" CRC Press, Fourth Edition,2006.


**REFERENCE BOOKS:**


1. Coughanowr, D.R., "Process Systems Analysis and Control", McGraw -Hill international Edition, 2004.
2. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003
3. E. Ikonen and K. Najim, " Advanced Process Identification and Control", Marcel Dekker, Inc. Newyork, 2002.
4. P. Albertos and S. Antonio, "Multivariable Control Systems An Engineering Approach", SpringerVerlag, 2004.


**WEB REFERENCE:**

1. nptel.ac.in/downloads/103101003/

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| | |
|---|---|
| **Course Code:** 140EI9120 | **Course Title: DIGITAL CONTROL AND STATE VARIABLE METHODS** (Common to EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 1: 0 : 4 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 60 |

**Pre-requisites:** The student should have undergone the course(s):

- Engineering Mathematics – I, II,III
- 140EI0501 - Control Engineering
- 140EI0602 – Principles of Digital Signal Processing

**Course Outcomes:**

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

**CO1:** Distinguish the conventional and state variable approaches.

**CO2:** Solve the problems on discrete systems.

**CO3:** Analyze the real time problems using discrete data system.

**CO4:** Design the digital controller and its algorithms.

**CO5:** Analyze the various system stabilities using liapunov technique.

**Course Content:**

**UNIT I DISCRETE STATE SPACE MODEL 12**

Limitations of conventional control theory - Concepts of state, State variables and state model – state model for linear time invariant systems: State space representation using physical-Phase and canonical variables.

**UNIT II SYSTEM RESPONSE 12**

Transfer function from state model - Transfer Function matrix - Decomposition of transfer functions- Direct, cascade and parallel decomposition techniques - Solution of state equation - State transition matrix computation.

**UNIT - III ANALYSIS OF DISCRETE DATA SYSTEM 12**

State-space representation of discrete data systems – Selection of sampling process – Selection of sampling period – Review of z-transform – Pulse transfer function – Modified z-transform - Stability of discrete data system – Jury's stability test.

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**UNIT - IV DESIGN OF DIGITAL CONTROLLER 12**

Digital PID – Position and velocity form – Deadbeat's algorithm – Dahlin's algorithm –- Kalman's algorithm – Dead time compensator: Smith predictor.

**UNIT -V LIAPUNOV STABILITY 12**

Liapunov stability analysis - Stability in the sense of Liapunov - Definiteness of Scalar Functions – Quadratic forms - Second method of Liapunov - Liapunov stability analysis of linear time invariant systems.

**TEXT BOOKS:**


1. Gopal M, "Digital Control and State Variable Methods", Tata McGraw-Hill Publishing Company Limited, New Delhi, India, Second Edition, 2012.
2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Ltd., New Delhi, Third Edition, 2009.


**REFERENCE BOOKS:**


1. Nagrath I J and Gopal M, "Control Systems Engineering", New Age International Publisher, New Delhi, 2010.
2. Nise S Norman, "Control Systems Engineering", John Wiley & Sons, Inc, Delhi, Third edition, 2010.
3. Benjamin C Kuo, "Automatic Control Systems",John Wiley & Sons, Inc., Delhi, 2009.
4. Thomas Kailath, "Linear Systems", Prentice Hall, 1980.


**WEB REFERENCE:**

1. www.gcebargur.ac.in
2. www.goodreads.com/59581.
3. nptel.ac.in/courses/108103008/25
4. web.mit.edu/2.14/StateSpace.pdf
5. www.nptelvideos.in/control-engineering.htm

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| Course Code: 140EI9121 | Course Title: NEURAL NETWORK AND FUZZY LOGIC CONTROL |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Conceptualize the human brain using Neural Network along with its various types of architectures

**CO2:** Elaborate the real time applications of neural network

**CO3:** Describe the basics of fuzzy logic and neural network techniques

**CO4:** Explain the various optimization techniques for fuzzy logic systems

**CO5:** Identify the efficient hybrid system for different applications

**Course Content:**

**UNIT I ARCHITECTURES** 9

Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors.

**UNIT II NEURAL NETWORKS FOR CONTROL** 9

Feedback networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

**UNIT - III FUZZY SYSTEMS** 9

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules.

**UNIT - IV FUZZY LOGIC CONTROL** 9

Membership function – Knowledge base – Decision-making logic – Optimisation of membership function using neural networks – Adaptive fuzzy system – Introduction to genetic algorithm.

**UNIT -V APPLICATION OF FLC** 9

Fuzzy logic control – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia – Introduction to neuro fuzzy controller.

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Pollachi - 642 003, Coimbatore District, Tamilnadu.

**TEXT BOOKS:**


1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.


**REFERENCE BOOKS:**


1. LauranceFausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. H.J. Zimmermann, 'Fuzzy Set Theory & its Applications', Allied Publication Ltd., 1996.
3. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
4. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| Course Code: 140EI9122 | Course Title: INSTRUMENTATION AND CONTROL IN PAPER INDUSTRIES |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours: 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0501 - Control Engineering

**Course Outcomes:**

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

**CO1:** Analyze the basic processing parameters involved in paper mill.

**CO2:** Describe the measuring equipments used in paper industries.

**CO3:** Identify different kinds of valves involved in paper industry.

**CO4:** Explain the various control methods involved in paper industry.

**CO5:** Analyze about the applications of computers in industry.

**Course Content:**

**UNIT I DESCRIPTION OF THE PROCESS 9**

Raw material – Basic process – Pulping process – Chemical recovery process – Paper making Process –Converting.

**UNIT II MEASUREMENT HARDWARE AND ANALYZERS 9**

Thickness Standards - Thickness Measurements; Measurement of basis weight – Sensors –Density-Specific gravity – Flow-level of liquids and solids – Detectors – Pressure – Temperature – Consistency sensors – Moisture analyzers –Oxidation – Reduction Potential and pH – Graphic displays and alarms.

**UNIT - III VALVES 9**

Selection factors – Valve types – Ball, butterfly, gate, plug, pinch applications.

**UNIT - IV CONTROL SYSTEMS 9**

Blow down tank controls – Digester liquor feed pump controls – Brown stock washer level control – Stock chest level control – Basis weight control – Dryer temperature control – Dissolving tank density control – White liquor flow controls – Time storage silo level detection – Condensate conductivity control.

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**UNIT -V COMPUTER APPLICATIONS** 9

Application – Control and measuring devices – Stepper motor and gear train application – Industrial robots in production lines.

**TEXT BOOKS:**


1. Liptak, B.G., "Instrumentation in processing Industries", Chilton Book, 1973.
2. Considine, D.M., "Hand book of Applied Instrumentation" Tata McGraw-Hill,1984.


**REFERENCE BOOKS:**


1.Howar P. Kallen, "Hand book of Instrumentation and Control", Tata McGraw-Hill, 1961.

2.Robert J. Bibbero, "Microprocessors in Industrial Control" ISA Press, 1983.

3.James A. Gupton Jr., "Computer Controlled Industrial Machine Process and Robots", Prentice Hall of India, 1986.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| | |
|---|---|
| **Course Code:** 140EI9123 | **Course Title: INDUSTRIAL DRIVES AND CONTROL** (Common to EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0306 - Electrical Machines and Measurements
- 140EI0506 - Power Electronics

**Course Outcomes:**

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

**CO1:** Identify the need and choice of various drives.

**CO2:** Explain different speed control methods in D.C and A.C drives and its control schemes.

**CO3:** Illustrate the various control methods for A.C. Drives

**CO4:** Describe the control mechanism of special machine drives

**CO5:** Elaborate the digital control schemes for special machine drives

**Course Content:**

**UNIT I INTRODUCTION** **9**

Selection of drives – Factors influencing the choice of drive – Braking methods – Temperature rise and RMS rating – Power converters using IGBT and MOSFET – Open loop and closed loop control of drives – Sensors used in drives.

**UNIT II CONTROL OF DC DRIVES** **9**

Single phase and three phase converter fed drives – Continuous and discontinuous modes – Chopper fed drives – Four quadrant drives – Closed loop drive system.

**UNIT - III CONTROL OF AC DRIVES** **9**

Voltage control, v/f control of induction motor – VSI and CSI fed drives – Rotor resistance control and slip power recovery scheme – Closed loop control induction motor drives – Vector control.

**UNIT - IV CONTROL OF SPECIAL DRIVES - I** **9**

Stepper motor – Types- Static and Dynamic Characteristics- Driver circuit – Digital Implementation- Open loop and Closed Loop Control - AC and DC servomotor control.

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**UNIT -V CONTROL OF SPECIAL DRIVES - II** **9**

Permanent Magnet DC (PMDC) motor-Principle-Performance Characteristics -Types - BLDC motor-Principle, Construction and operation- Types of BLDC motor- Control of BLDC motor-Microprocessor and DSP based control schemes -Sensor less Control- Applications.

**TEXT BOOKS:**


1. R. Krishnan, 'Electric Motor and Drives: Modelling Analysis and Control', Pearson Education, 2001.
2. G.K. Dubey, 'Fundamentals of Electrical Drives', Narosa Publication, 2002.


**REFERENCE BOOKS:**


1. E.G.Janardanan, 'Special Electrical Machines', Prentice Hall of India, 2014.
2. Bimal. K. Bose, 'Modern Power Electronics and AC Drives', Prentice Hall of India, 2003.
3. Chesmond, Wilson and Lepla, 'Advanced Control System Technology', Viva low priced student edition, 1998.


**WEB REFERENCE:**

1. www.nptel.ac.in

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| Course Code:140EI9124 | Course Title: NON LINEAR CONTROL SYSTEM (Common to EIE and ICE) |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 1: 0 : 4 : 100 |
| Type: Lecture | Total Contact Hours:60 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0501 - Control Engineering

**Course Outcomes:**

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

**CO1:**Determine the stability of non-linear system using phase plane method

**CO2:**Derive the describing function for the non-linear elements, such as relay, hysteresis, dead zone, saturation and backlash

**CO3:**Comment on the stability of non-linear system using appropriate

**CO4:**Design the non-linear controller using state feedback and state observer

**CO5:**Describe the sliding motor control method

**Course Content:**

**UNIT I PHASE PLANE ANALYSIS 12**

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

**UNIT II DESCRIBING FUNCTION ANALYSIS 12**

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

**UNIT - III STABILITY ANALYSIS 12**

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

**UNIT - IV STATE FEEDBACK AND STATE OBSERVERS 12**

State Feedback - Gain Matrix - Pole Placement design using State feedback system – State observer Full order Observer-Reduced order observer – Design of state observer system.

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**UNIT -V SLIDING MODE CONTROL** **12**

Variable structure systems - Basic concepts - Sliding modes in variable structure system conditions for existence of sliding regions – Case Study - Sliding mode approach to speed control of dc motors.

**TEXT BOOKS:**


1. M.Gopal, 'Modern control system theory', New Age International Publishers, Second Edition,2005
2. Ogata, 'Modern control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.


**REFERENCE BOOKS:**


1. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, "Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition.2008.
2. J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2010.
3. VadimUtkin, JurgenGuldner, Jingxin Shi, "Sliding Mode Control in Electromechanical System", Taylor and Francis, 1999.
4. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.


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| | |
|---|---|
| **Course Code:** 140EI9125 | **Course Title: MICRO ELECTRO MECHANICAL SYSTEMS** (Common to EEE, EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Explain the fundamentals of MEMS and Microsystems.

**CO2:** Describe the basics of Materials and micro fabrication process involved in MEMS.

**CO3:** Discuss the operation of micro devices, micro systems and their applications.

**CO4:** Explain the manufacturing of MEMS device or micro system

**CO5:** Express the principles of designing MEMS device or micro system.

**Course Content:**

**UNIT I MEMS DESIGN** **9**

Overview - Microsystems and microelectronics - Working principle of Microsystems - micro actuationtechniques-microsensors-types-microactuators-types-micropump-micromotors-microvalves-microgrippers-scaling laws-scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity- scaling in fluid mechanics- scaling in heat transfer.

**UNIT II MATERIALS AND FABRICATION PROCESS** **9**

Substrates and wafer-single crystal silicon wafer formation-ideal substrates-mechanical properties- silicon compounds - Sio2, SiC, Si3N4 and polycrystalline silicon - Silicon piezoresistors - Gallium arsenide, Quartz-piezoelectric crystals-polymers for MEMS-conductive polymers- Photolithography - Ion implantation - Diffusion– Oxidation –CVD - Physical vapor deposition by epitaxy - etching process.

**UNIT - III MICROMECHANIC** **9**

Introduction-static bending of thin plates-circular plates with edge fixed - rectangular plate with all edges fixed and square plate with all edges fixed – Mechanical vibration-resonant vibration- micro accelerometers-design theory and damping coefficients- thermo mechanics -thermal stresses-fracture mechanics-stress intensity factors, fracture toughness and interfacial fracture mechanics.

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**UNIT - IV MICRO SYSTEM MANUFACTURING 9**

Clean room technology-Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing.

**UNIT -V MICRO SYSTEM DESIGN 9**

Design considerations-process design-mask layout design- mechanical design-applications of micro system in -automotive industry-bio medical –aerospace-telecommunications.

**TEXT BOOKS:**


1. Gad-el-Hak, Mohamed, 'The MEMS Hand book', CRC press, New York, 2002.
2. Hsu, Tai-Ran., 'MEMS and Microsystems Design and Manufacture', Tata McGraw-Hill, New Delhi, 2006.


**REFERENCE BOOKS:**


1. Fatikow, S. and Rembold, U., 'Microsystem Technology and Microrobotics', Springer-Verlag Berlin, 1997.
2. Tay, Francis E.H. and Choong, W.O., 'Microfludics and BioMEMS Applications', Springer, Berlin, 2002.
3. Gardner, Julian W., Varadan, Vijay K. and AwadelKarim, Osama O., 'Micro sensors MEMS and Smart Devices', John Wiley & Sons, New York, 2001.


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| | |
|---|---|
| **Course Code:** 140EI9126 | **Course Title: ROBOTICS AND AUTOMATION** (Common to EEE, EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Mathematics
- 140EI0303 - Transducer Engineering
- 140EI0306 - Electrical Machines and Measurements

**Course Outcomes:**

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

**CO1:** Analyze the various parts of robotics and its automation

**CO2:** Identify the sensors and drive systems for developing a robot

**CO3:** Derive kinematics and dynamics equation for functioning the robots

**CO4:** Program a robot using lead through programming methods

**CO5:** Describe the Robots used in various application

**Course Content:**

**UNIT I BASIC CONCEPTS** **9**

Automation and Robotics – Asimov's laws of robotics - Robot Anatomy – basic Components of Robots system - classification of Robots by configuration – Robot Motion – Precision of movements - end effectors.

**UNIT II POWER SOURCES, SENSORS AND DRIVE SYSTEM** **9**

Actuators - Hydraulic, pneumatic and electric drives – Mechanical power transmission System: Bearings, Gears, Belt and chains – Sensors: Position, Velocity, tactile sensors, Proximity and range sensor – Machine vision: Sensing and digitizing, Image processing and applications.

**UNIT - III KINEMATICS AND DYNAMICS** **10**

Solution of direct and inverse kinematics problem – Manipulator path control – Robot dynamics - Robot trajectories - Jacobian work envelope - Robot cycle time analysis.

**UNIT - IV ROBOT PROGRAMMING** **8**

Methods of Robot programming – lead through programming methods – robot program as a path in space – motion interpolation – weight, signal and delay commands – Branching capabilities – Robot programming examples for pick and place application using VAL.

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**UNIT -V CASE STUDIES** **9**

Robots in manufacturing and non-manufacturing application – Robot cell design –selection of robot - factory automation – FMS and CIM. Applications - material handling, processing operations, assembly and inspection.

**TEXT BOOKS:**


1. Mikell P. Groover, MilchelWein Roger Nagel and Nicholas G. Ordy,"Industrial Robotics, Technology, Programming and Applications", McGraw Hill, Last Print, 2005.
2. Fu, K.S., Gonzalez RC., and Lee C.S.G., "Robotics control, sensing, vision and intelligence," McGraw Hill, 1987.


**REFERENCE BOOKS:**


1. Deb.S.R, "Robotics Technology and Flexible Machine Design", Tata McGraw Hill, 2005.
2. Klafter R.D., Chimielewski T.A. and Negin M., 'Robotic Engineering – An integrated Approach', Prentice Hall of India, New Delhi, 2005
3. Syed B. Niku, 'Introduction to Robotics Analysis, Systems, Applications', Prentice Hall of India/Pearson Education, Asia, 2001.


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| | |
|---|---|
| **Course Code:** 140EI9127 | **Course Title: WIRELESS SENSOR NETWORKS** (Common to EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0404 - Communication Engineering

**Course Outcomes:**

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

**CO1:** Explain the Adhoc Sensor Networks

**CO2:** Explain the sensor Node architecture

**CO3:** Illustrate the knowledge on Network protocols

**CO4:** Describe the operation of Sensor Tasking and Control.

**CO5:** Elicite the plat form of sensor network and its tools

**Course Content:**

**UNIT I ADHOC AND SENSOR NETWORKS 9**

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols - Difference between mobile ad-hoc and sensor networks.

**UNIT II ARCHITECTURES 9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**UNIT - III NETWORKING SENSORS 10**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses.

**UNIT - IV INFRASTRUCTURE ESTABLISHMENT 8**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

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**UNIT -V SENSOR NETWORK PLATFORMS AND TOOLS 9**

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware –Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

**TEXT BOOKS:**


1. Holger Karl, Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley, 2005.
2. Feng Zhao, Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach', Elsevier, 2007.


**REFERENCE BOOKS:**


1. KazemSohraby, Daniel Minoli, andTaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. BhaskarKrishnamachari,'Networking Wireless Sensors', Cambridge Press,2005.
4. Mohammad IlyasandImadMahgaob, 'Handbook of Sensor Networks: Compact Wireless And Wired Sensing Systems', Crc Press, 2005.


**WEB REFERENCE:**

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| | |
|---|---|
| **Course Code:** 140EI9128 | **Course Title: INDUSTRIAL DATA COMMUNICATION NETWORKS** (Common to EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140EI0404 - Communication Engineering / Equivalent subject
- 140EI0405 - Digital Principles and Applications / Equivalent subject

**Course Outcomes:**

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

**CO1:** Explain industrial data communication protocol and standards

**CO2:** Identify, prevent and troubleshoot industrial data communication problems

**CO3:** Describe the fieldbus configuration in networking

**CO4:** Illustrate the wired and wireless communications used in Process and Industrial Automation

**CO5:** Illustrate the wireless communication standards and cellular technology.

**Course Content:**

**UNIT I INTRODUCTION** **9**

Modern Instrumentation and Control Systems– Introduction to Networks–Advantages and Disadvantages.OSI Model–Foundations of OSI Model.Protocol – Standards. Grounding, Shielding and Noise. Basics of Digital Modulation techniques.EIA232–Overview.EIA485– Overview. Current loop and EIA Converters.

**UNIT II INDUSTRIAL ETHERNET** **9**

Introduction–IEEE Standards– Ethernet MAC layer –IEEE 802.2 and Ethernet SNAP– OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches and switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet. TCP / IP Overview– Internet Layer Protocols– Host-to-Host layer.

**UNIT - III INDUSTRIAL PROTOCOL** **7**

Overview–Protocol Structure–Example Function codes. ASCII based protocol - Modbus protocol–Overview. HART Protocol – Overview – Layers.

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**UNIT - IV FIELD BUS** **10**

AS-i Bus - Protocol Stack - CAN bus – Overview– Layers – Profibus–Overview–Protocol Stack. FIP and World FIP - Foundation Field Bus– Layers– Error Detection and Diagnostics - Redundancy.

**UNIT -V WIRELESS COMMUNICATION** **10**

Wireless LANs – IEEE 802.11 standard – Bluetooth Technology – Interconnection of LANs - Wireless WANs – Introduction to Cellular Telephony-1G, 2G, GSM and 3G – Satellite networks.

**TEXT BOOKS:**


1. Behrouz A Forouzan, 'Data Communications and Networking', Tata McGraw-Hill, Fifth Edition, 2013.
2. John Park, Steve Mackay and Edwin Wright, 'Practical Data Communications for Instrumentation and Control', Elsevier, IDC Technologies, First Edition, 2003.


**REFERENCE BOOKS:**


1. Steve Mackay, Edwin Wright, John Park and Deon Reynders, 'Practical Industrial data Networks: Design, Installation and TroubleShooting', Elsevier International Projects Ltd., First Edition, 2004.
2. William Buchanan, 'Computer Buses- Design and Application', CRC Press, First Edition, 2000.
3. Theodore S Rappaport, 'Wireless Communications: Principles and Practice', Prentice Hall PTR, Second Edition, 2002.


**WEB REFERENCE:**

1. www.nptel.ac.in/courses/108105057/Pdf/
2. nptel.iitg.ernet.in/Courses.php

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| Course Code:140EI9129 | Course Title: DISASTER MANAGEMENT (Common to EIE and ICE) |
|---|---|
| Core/Elective: Elective | L : T : P : C : M – 3 : 0: 0 : 3 : 100 |
| Type: Lecture | Total Contact Hours:45 |

**Pre-requisites:** The student should have undergone the course(s):

- 140CO204 - Environmental Science

**Course Outcomes:**

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

**CO1:** Distinguish the natural and manmade disasters

**CO2:** Identify the environment hazards and level of toxicology

**CO3:** Summarize the usefulness of integrating management principles in disaster mitigation work

**CO4:** Explain the causes and effects of Earthquake , Cyclone and Tsunami formation

**CO5:** Describe about modern technological tools in disaster management

**Course Content:**

**UNIT I INTRODUCTION 9**

Disaster- Disaster management- Disaster prevention and preparedness measures-Types of Disaster – Causal factor of Disaster – Natural, Manmade, creeping disaster-Disaster in the Indian context- various measures – Disaster related policy goals – United Nations Development Program (UNDP) – United Nations Disaster Relief Organization (UNDRO) – Govt. of India.

**UNIT II ENVIRONMENTAL DISASTER 9**

Environmental hazards – Typology – Assessment and response – the strategies– the scale of disaster – Vulnerability – Disaster trends – Paradigms towards abalanced view – Chemical hazards and Toxicology – Biological hazards –Hazard caused by world climate change – Risk analysis – other technological disasters.

**UNIT - III EARTHQUAKE AND TSUNAMI 9**

Earthquake – Causes of earthquake – Earthquake scales – Measures of earth –quake – Magnitude and Intensity – Earthquake Recurrence hazard assessment –Seismic zoning – Earthquake disaster mitigation – Component research focus –Forecasting techniques and Risk analysis – Tsunami – Causes of Tsunami –Effects of Tsunami – Tsunami warning system – Tsunami warning system in India – International status of Tsunami warning and communication system –Tsunami warning centers – Pacific Tsunami Warning Center (PTWC) – Pacific Tsunami Warning System (PTWS) components – Institutional arrangements and design criteria for Tsunami mitigation.

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**UNIT - IV CYCLONE** 9

Tropical cyclone- Warning system – Protection of buildings from cyclones-Precaution before and during cyclones – Tropical cyclone warning strategy in India – Cyclone related problems – aerial survey – Management strategy – risk reduction by public awareness and education.

**UNIT -V APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMEN** 9

Hazard map – Multi hazard mapping – Application of satellites in Disaster Management – Application of remote sensing in forecasting and disaster relief –Use of digital image processing in disaster management – GIS in disaster management – Spatial data – GIS data base design – Convention mapping concepts and Coordinate system – Methods of spatial Interpolation in GIS.

**TEXT BOOKS:**


1. PardeepSahni, Madhavimalalgoda and ariyabandu, "Disaster risk reduction in south asia", PHI
2. AmitaSinhal, "Understanding earthquake disasters" TMH, 2010.


**REFERENCE BOOKS:**


1. PardeepSahni, AlkaDhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI
2. Jeff Groman (2002) The atlas of Natural Disasters by (author) Publisher: Friedman/Fairfax publishing;(March 2002)
3. Jaikrishna&Chandrasekar, Elements of Earthquake Engineering.


**WEB REFERENCE:**

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| | |
|---|---|
| **Course Code:** 140EI9130 | **Course Title: PROFESSIONAL ETHICS AND HUMAN VALUES** (Common to EEE, EIE and ICE) |
| **Core/Elective: Elective** | **L : T : P : C : M** – 3 : 0: 0 : 3 : 100 |
| **Type:** Lecture | **Total Contact Hours:** 45 |

**Pre-requisites:** The student should have undergone the course(s):

- Nil

**Course Outcomes:**

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

**CO1:** Describe the legal requirements, ethical issues, and professional issues in the work place.

**CO2:** Elucidate the broad education and to value the impact of engineering solutions in a global and societal context

**CO3:** Summarize contemporary issues related to human and professional interactions at workplace

**CO4:** Illustrate the engineer's life-long commitment to serve the destitute

**CO5:** Explain the working environment for its safety measures

**Course Content:**

**UNIT I ENGINEERING ETHICS** 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry –Moral dilemmas. Moral Autonomy – Kohlberg's theory – Gilligan's theory – Controversy and Consensus– Professions and Professionalism – Professionalideals and virtues – Theories about right action – Self-interest – Customs andreligion – Use of Ethical Theories.

**UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION** 9

Engineering as experimentation – Engineers as responsible experimenters –Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study.

**UNIT - III ENGINEER'S RESPONSIBILITY FOR SAFETY** 9

Standards – safety regulations - Safety and risk – Assessment of safety and risk – Risk Benefit Analysis –Reducing risk – The Three Mile Island and Chernobyl Case Studies.

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**UNIT - IV RESPONSIBILITIES AND RIGHTS** 9

Collegiality and loyalty – Respect for Authority – Collective Bargaining –Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights– Employee Rights – Discrimination.

**UNIT -V GLOBAL ISSUES** 9

Multinational Corporations – Environmental Ethics – Computer Ethics – WeaponsDevelopment – Engineers as Managers – Consulting Engineers – Engineers asExpert Witnesses and Advisors – Moral Leadership – Sample code of conduct – Elnino effect – Kyoto protocol.

**TEXT BOOKS:**

1. Krishnaswamy K, Thangaraj K and Karmegam G, "A Guide to Professional Ethics and Human Values", R.K. Publishers, First edition 2005

**REFERENCE BOOKS:**

1.Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw-Hill, New York, 1996

2.Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999

3.Laura Schlesinger, How Could You Do That: The Abdication of Character, Courage, and Conscience, Harper Collins, New York, 1996.

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