School of Electrical Sciences
Dept. of Electrical and Electronics Engineering

UG SYLLABUS AND CURRICULUM

Choice Based Credit System (CBCS)
(Applicable for students admitted with effect from 2015 – 16)

“TO MAKE EVERY MAN A SUCCESS AND NO MAN A FAILURE”

No. 1, Rajiv Gandhi Salai (OMR) | Padur | Chennai - 603 103
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VISION, MISSION OF THE DEPARTMENT

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

- To educate the students in the recent developments of emerging fields in Electrical and Electronics Engineering, to encourage research activities, innovate techniques and to develop managerial abilities so as to make them excel globally.

MISSION

- To impart quality education in Electrical and Electronics Engineering.
- To upgrade curriculum continuously to meet the industrial requirement.
- To develop ability for research, innovation and entrepreneurship.
- To promote awareness about social and ethical responsibilities.
### PROGRAMME EDUCATIONAL OBJECTIVES (PEO) –  
(to be achieved by the graduate after 4 to 5 years of graduation)

<table>
<thead>
<tr>
<th>PEO-1</th>
<th>To prepare students for successful careers in Industry and Academics that meets the need of global industries.</th>
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<tr>
<td>PEO -2</td>
<td>To enable the students to obtain breadth and depth through required core courses in circuits, electronics, communications, control systems, microprocessors, electromagnetics and electric machines, elective courses consistent with the range of technical specialties and required courses from other disciplinary.</td>
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<tr>
<td>PEO -3</td>
<td>To enable the students to function as accomplished professionals in electrical engineering field with due emphasis on personality development and communication skills.</td>
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<td>PEO -4</td>
<td>To provide opportunity for students to work as part of teams on multidisciplinary projects</td>
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<td>PEO-5</td>
<td>To enable the student to adapt to absorb new techniques and innovate in modern technological environment.</td>
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### PROGRAMME OUTCOMES

**PROGRAMME OUTCOMES**  
(To be achieved by the student after every semester/year/and at the time of graduation)

<table>
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<tr>
<th>PO-1</th>
<th>Ability to apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex Electrical and Electronics engineering problem.</th>
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<tr>
<td>PO -2</td>
<td>Ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences</td>
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<td>PO -3</td>
<td>Ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.</td>
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<td>PO -4</td>
<td>Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.</td>
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<td>PO -5</td>
<td>Ability to create, select and apply appropriate techniques, resources and modern engineering tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</td>
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<td>PO-6</td>
<td>Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
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<td>PO -7</td>
<td>Ability to understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development</td>
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<td>PO -8</td>
<td>Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice</td>
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<td>PO -9</td>
<td>Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.</td>
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<td>PO -10</td>
<td>Ability to communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, comprehension and writing effective reports and design documentation, make effective presentations and give and receive clear instructions.</td>
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<td>PO -11</td>
<td>Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments</td>
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<td>PO-12</td>
<td>Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.</td>
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**SEEMESTER III**

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**Goal**
The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

**Objectives**
The course should enable the students:

(i) To widen the capacity of the learners to listen to English language at the basic level and

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</tr>
</tbody>
</table>

**Semester I**

**ELA101 Technical English**

3 CREDITS
understand its meaning.

(ii) To enable learners to communicate in an intelligible English accent and pronunciation.

(iii) To assist the learners in reading and grasping a passage in English.

(iv) To learn the art of writing simple English with correct spelling, grammar and punctuation.

(v) To cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME

(i) The learners will have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.

(ii) The learners will be able to speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.

(iii) The learners will be able to read, comprehend and answer questions based on literary, scientific and technological texts.

(iv) The learners will be able to write instructions, recommendations, checklists, process-description, letter-writing and report writing.

(v) The learners will have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I LISTENING SKILL

Topics: Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading -- Listening exercises.

Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form -- Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.

UNIT II SPEAKING SKILL

Topics: Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interaction -- Speaking on a topic -- Expressing views for & against -- Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.


UNIT III READING SKILL

Topics: Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- Words and their function -- Different grammatical forms of the same word.

UNIT IV WRITING SKILL

Topics: Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts - Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing --
Letter to the editors - Letter inviting & accepting or declining the invitation - Placing orders - Complaints – Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter.
Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions -- Direct and indirect speech.

UNIT V THINKING SKILL
Topics: Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs.
Embedded language learning: General vocabulary -- Using expressions of cause and effect -- Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

REFERENCES

MAA101 ENGINEERING MATHEMATICS - I
4 CREDITS

GOAL
To impart comprehensive knowledge in engineering mathematics.

OBJECTIVES
The course should enable the students to:
(i) Find the inverse of the matrix by using Cayley Hamilton Theorem and Diagonalisation of matrix using transformation.
(ii) Understand the Evolutes and Envelope of the curve.
(iii) Learn the solutions of second order linear differential equations of standard types and Legendre's linear differential equation.
(iv) Learn partial differentiations involving two and three variables and expansions of functions using Taylor series.
(v) Learn the expansions of trigonometric, hyperbolic functions and their relations.

OUTCOME
The students should be able to:
(i) Identify Eigen value problems from practical areas and obtain its solutions. Using transformation, diagonalising the matrix would render Eigen values.
(ii) Find out effectively the geometrical aspects of curvature and use mathematical skills in constructing evolutes and envelopes in mechanics and engineering drawing.
(iii) Recognize and model mathematically and solve the differential equations arising in science and engineering.
(iv) Understand and model the practical problems and solve it using maxima and minima as elegant applications of partial differentiation.
(v) Acquire skills using trigonometric, hyperbolic and inverse hyperbolic functions.
UNIT I  MATRICES  

UNIT II  DIFFERENTIAL CALCULUS  

UNIT III ORDINARY DIFFERENTIAL EQUATIONS  

UNIT IV  PARTIAL DIFFERENTIATION  

UNIT V  TRIGONOMETRY  
Review: Basic results in trigonometry and complex numbers - De Moivre’s theorem. Expansions of sinn, cosn, tann where n is a positive integer. Expansions of in terms of sines and cosines of multiples of where m and n are positive integers. Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers - Separation of complex functions into real and imaginary parts - Simple problems.

Note: Questions need not be asked from review part.

TOTAL: 60

TEXT BOOKS

REFERENCES
PHA101 ENGINEERING PHYSICS

3 CREDITS

GOAL
To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES
The course should enable the students:
(i) To develop strong fundamentals of properties and behavior of the materials
(ii) To enhance theoretical and modern technological aspects in acoustics and ultrasonics.
(iii) To enable the students to correlate the theoretical principles with application oriented study of optics.
(iv) To provide a strong foundation in the understanding of solids and materials testing.
(v) To enrich the knowledge of students in modern engineering materials.

OUTCOME
The students should be able to:
(i) Understand the properties and behavior of materials.
(ii) Acquire fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and ultrasonic.
(iii) Understand the concept, working and application of lasers and fiber optics.
(iv) Know the fundamentals of crystal physics and non-destructive testing methods.
(v) Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER

UNIT II ACOUSTICS AND ULTRASONICS
Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostiriction and Piezoelectric methods - properties applications of ultrasonics with particular reference to detection of flaws in metal ( Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS

UNIT IV CRYSTAL PHYSICS AND NON-DESTRUCTIVE TESTING
Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number.
- Packing factor for SC, BCC, FCC and HCP structures.
Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS
Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL = 45

TEXT BOOKS:

REFERENCES:

CYA101 ENGINEERING CHEMISTRY
3 CREDITS

GOAL
To impart basic principles of chemistry for engineers.

OBJECTIVES
(i) To make the students conversant with the basics of Water technology.
(ii) To make the students conversant with the basics of Polymer science.
(iii) To provide knowledge on the requirements and properties of a few important engineering materials.
(iv) To educate the students on the fundamentals of corrosion and its control.
(v) To give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
(vi) To create an awareness among the present generation about the various conventional energy sources.

OUTCOME
(i) The students will gain basic knowledge in water analysis and suitable water treatment method.
(ii) The study of polymer chemistry will give an idea on the type of polymers to be used in engineering applications.
(iii) Exposure of the students to the common engineering materials will create awareness among the students to search for new materials.
(iv) Knowledge on the effects of corrosion and protection methods will help the young minds
to choose proper metal / alloys and also to create a design that has good corrosion control.

(v) Students with good exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.

(vi) A good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment - Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics - Polymer Blends and Polymer Alloys - Definition, Examples.

UNIT II ENGINEERING MATERIALS

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications - Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives - Classification, Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion, examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) - Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS


UNIT V FUELS AND ENERGY SOURCES


TOTAL : 45

TEXT BOOKS

REFERENCES
1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
2. A. Gowarikar, Text Book of Polymer Science, 2002
3. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004

CSA101 COMPUTER PROGRAMMING

GOAL
To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

OBJECTIVES
The course should enable the students to:
1. Learn the major components of a Computer system.
2. Learn the problem solving techniques.
3. Develop skills in programming using C language.

OUTCOME
The student should be able to:
1. Understand the interaction between different components of Computer system and number system.
2. Devise computational strategies for developing applications.
3. Develop applications (Simple to Complex) using C programming language.

UNIT I COMPUTER FUNDAMENTALS

UNIT II COMPUTER PROGRAMMING AND LANGUAGES

UNIT III PROGRAMMING WITH C
Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.
UNIT IV FUNCTIONS, ARRAYS AND STRINGS  
Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT V POINTERS, STRUCTURES AND UNION  
Pointers - Dynamic Memory allocation - Structure and Union - Files.

TOTAL = 45

TEXT BOOK

REFERENCES

PHA131 PHYSICS LAB

OBJECTIVES
The course should enable the students to:
I. Determine the rigidity modulus of the material of a wire by Torsional Pendulum experiment
II. Find the Young's Modulus of a Non Uniform Bending material
III. Determination of thermal conductivity of a bad conductor by Lee's disc method
IV. Determination of thickness of a thin wire by Air Wedge method
V. Find the Refractive index of a prism by using Spectrometer

OUTCOME
The students should be able to:
1. Determine the rigidity modulus of the material of a wire
2. Determine the Young's Modulus of a Non Uniform Bending material.
3. Determine the thermal conductivity of a bad conductor
4. Determine the thickness of a thin wire
5. Find the Refractive index of a prism using Spectrometer

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments</th>
<th>Batch 2</th>
<th></th>
<th>Batch 1</th>
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<td>Periods allotted</td>
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<td>P</td>
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<td>1</td>
<td>Torsional Pendulum - Determination of rigidity modulus of the material of a wire.</td>
<td>1</td>
<td>3</td>
<td>2</td>
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<tr>
<td>2</td>
<td>Non Uniform Bending - Determination of Young's Modulus.</td>
<td>3</td>
<td>3</td>
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<tr>
<td>3</td>
<td>Viscosity - Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>3</td>
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<tr>
<td>No.</td>
<td>Experiment</td>
<td>Periods</td>
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<td>4</td>
<td>Lee's Disc - Determination of thermal conductivity of a bad conductor.</td>
<td>7 3 8 3</td>
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<tr>
<td>5</td>
<td>Air Wedge - Determination of thickness of a thin wire.</td>
<td>9 3 10 3</td>
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<tr>
<td>6</td>
<td>Spectrometer - Refractive index of a prism.</td>
<td>11 3 12 3</td>
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<td>7</td>
<td>Semiconductor laser - Determination of wavelength of Laser using Grating.</td>
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<td><strong>7 7</strong></td>
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21 Periods
LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1. Torsional Pendulum (500 gm, wt, 60 cm wire Al-Ni Alloy) 5 nos.
2. Travelling Microscope (X10) 15 nos.
3. Capillary tube (length 10 cm, dia 0.05 mm) 5 nos.
4. Magnifying lens (X10) 15 nos.
5. Lee's disc apparatus (std form) 5 nos.
6. Stop watch (+/- 1 s) 5 nos.
7. Meter scale 1 m length 5 nos.
8. Spectrometer (main scale 360 deg, ver 30") 5 nos.
9. Grating (2500 LPI) 5 nos.
10. Laser (632.8 nm) 5 nos.
11. Semi transparent glass plate Al coating, 65 nm thickness, 50% visibility 5 nos.
12. Equilateral prism (n = 1.54) 5 nos.
13. Thermometer +/- 1 deg 8 nos.
14. Screw gauge (+/- 0.001 cm) 12 nos.
15. Vernier caliper (+/- 0.01 cm) 8 nos.
16. Steam Boiler 1 L 5 nos.
17. Scale 50 cms 5 nos.
18. Cylindrical mass 100 gms 10 sets
19. Slotted wt 300 gms 5 sets
20. Heater 1.5 KW 5 nos.
21. Transformer sodium vapour lamp 1 KW 10 nos.
22. Sodium vapour lamp 700 W 5 nos
23. Burette 50 mL 5 nos
24. Beaker 250 mL 5 nos
25. Spirit level 10 nos

TOTAL: 21

REFERENCES:

CYA131 CHEMISTRY LAB

GOAL
To impart fundamental knowledge in various chemistry experiments.

OBJECTIVES
The course should enable the students to:
1. Estimate the Commercial soda by acid-base titration
2. Determine the Percentage of nickel in an alloy
3. Determine the Temporary, permanent and total hardness of water by EDTA method
4. Determine the Chloride content in a water sample
5. Do conductometric Titration of mixture of acids
6. Determine the Degree of polymerization of a polymer by Viscometry
OUTCOME
The students should be able to:
1. Estimate the Commercial soda by acid-base titration
2. Determine the Percentage of nickel in an alloy
3. Determine the Temporary, permanent and total hardness of water by EDTA method
4. Determine the Degree of polymerization of a polymer by Viscometry.

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
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<th>Batch 2</th>
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<td>L</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>Estimation of Commercial soda by acid-base titration</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Determination of Percentage of nickel in an alloy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Determination of Temporary, permanent and total hardness of water by EDTA method</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Determination of Chloride content in a water sample</td>
<td>7</td>
<td>3</td>
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<tr>
<td>5</td>
<td>Potentiometric Estimation of iron</td>
<td>9</td>
<td>3</td>
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<tr>
<td>6</td>
<td>Conductometric Titration of a strong acid with a strong base</td>
<td>11</td>
<td>3</td>
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<tr>
<td>7</td>
<td>Conductometric Titration of mixture of acids.</td>
<td>13</td>
<td>3</td>
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<tr>
<td>8</td>
<td>Determination of Degree of polymerization of a polymer by Viscometry</td>
<td>15</td>
<td>3</td>
</tr>
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<td><strong>TOTAL</strong></td>
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24 Periods
## LIST OF GLASSWARE AND EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
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<th>Description</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1</td>
<td>Burette (50 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>2</td>
<td>Pipette (20 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>3</td>
<td>Conical Flask (250 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>4</td>
<td>Distilled water bottle (1 L)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>5</td>
<td>Standard flask (100 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>6</td>
<td>Funnel (small)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>7</td>
<td>Glass rod 20 cm length</td>
<td>30 nos.</td>
</tr>
<tr>
<td>8</td>
<td>Reagent Bottle (250 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>9</td>
<td>Reagent Bottle (60 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>10</td>
<td>Beaker (100 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>11</td>
<td>Oswald Viscometer Glass</td>
<td>30 nos.</td>
</tr>
<tr>
<td>12</td>
<td>Measuring Cylinder (25 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>13</td>
<td>Digital Conductivity Meter PICO make</td>
<td>8 nos.</td>
</tr>
<tr>
<td>14</td>
<td>Conductivity cell (K=1)</td>
<td>12 nos.</td>
</tr>
<tr>
<td>15</td>
<td>Digital Potentiometer PICO make</td>
<td>8 nos.</td>
</tr>
<tr>
<td>16</td>
<td>Calomel Electrode Glass</td>
<td>12 nos.</td>
</tr>
<tr>
<td>17</td>
<td>Platinum Electrode Polypropylene</td>
<td>12 nos.</td>
</tr>
<tr>
<td>18</td>
<td>Burette Stands Wooden</td>
<td>30 nos.</td>
</tr>
<tr>
<td>19</td>
<td>Pipette stands Wooden</td>
<td>30 nos.</td>
</tr>
<tr>
<td>20</td>
<td>Retard stands Metal</td>
<td>30 nos.</td>
</tr>
<tr>
<td>21</td>
<td>Porcelain Tiles White</td>
<td>30 nos.</td>
</tr>
<tr>
<td>22</td>
<td>Clamps with Boss heads Metal</td>
<td>30 nos.</td>
</tr>
</tbody>
</table>

**TOTAL:** 24

### References:
CSA131 COMPUTER PROGRAMMING LAB

1 CREDIT

GOAL
To provide an awareness to develop the programming skills using computer languages.

OBJECTIVES
The course should enable the students:
(i) To gain knowledge about Microsoft office, Spread Sheet.
(ii) To learn a programming concept in C.

OUTCOME
The student should be able to:
(i) Use MS Word to create document, table, text formatting and Mail merge options.
(ii) Use Excel for small calculations using formula editor, creating different types of charts
and including pictures etc.
(iii) Write and execute the C programs for small applications.

LIST OF EXPERIMENTS:

a) Word Processing

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
4. Drawing - flow Chart

b) Spread Sheet

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document

c) Programming in C

8. To write a C program to prepare the electricity bill.
9. Functions:
   (a) Call by value   (b) Call by reference.
10. To write a C program to print the Fibonacci series for the given number.
11. To write a C program to find the factorial of number using recursion.
12. To write a C program to implement the basic arithmetic operations using Switch Case
    statement.
13. To write a C program to check whether the given number is an Armstrong number.
14. To write a C program to check whether the given string is a Palindrome.
15. To write a C program to create students details using Structures.
16. To write a C program to demonstrate the Command Line Arguments.
17. To write a C program to implement the Random Access in Files.
18. To write C programs to solve some of the Engineering applications

TOTAL : 45
HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE
LAN system with 33 nodes (OR) Standalone PCs - 33 Nos
Printers - 3 Nos

SOFTWARE
OS - Windows / UNIX
Application package - MS office
Software - C language

ELA131 COMMUNICATION SKILLS LAB - I
1 CREDIT

GOAL
The goal of the programme is to improve the communication skills of the students especially in English and assist them for their personal development as well

OBJECTIVES
The course should enable the students to:
(i) Extend the ability of the learners to be able to listen to English and comprehend its message.
(ii) Enable the learners to have a functional knowledge of spoken English.
(iii) Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
(iv) Help the learners develop the art of writing without mistakes.
(v) Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

OUTCOME
The students should be able to:
(i) Listen to and evaluate English without difficulty and comprehend its message.
(ii) Developed a functional knowledge of spoken English so as to use it in the institution and at job interviews.
(iii) Read and comprehend the meaning of technical and non-technical passages in English.
(iv) Developed the art of writing so as to put down their thoughts and feelings in words.
(v) Think independently and contribute creative ideas.

UNIT I LISTENING SKILL
Topics: Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV -- Talk shows - News - Educatve programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II SPEAKING SKILL
Topics: Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice indialogues -- Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -- academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III READING SKILL
Topics: Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures,
advertisements, pamphlets for improved presentation.

**UNIT IV - WRITING SKILL**

Topics: At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

**UNIT V - THINKING SKILL**

Topics: Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs. Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading.

**REFERENCES**


**Websites for learning English**

3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/

**Equipments required**

1. Career Lab: 1 room
2. Computers as a Server for Labs (with High Configuration)
3. LCD Projectors - 4 Nos
4. Headphones with Mic (i-ball) - 100 Nos
5. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
6. Teacher table, Teacher Chair - 1 + 1
7. Plastic Chairs - 75 Nos

**GEA131 ENGINEERING PRACTICES LAB - I**

(common to all branches)

1 CREDIT

**GOAL**

To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

**OBJECTIVES**

The course should enable the students to

(i) Relate theory and practice of basic Civil and Mechanical Engineering
(ii) Learn concepts of welding and machining practice
(iii) Learn concepts of plumbing and carpentry practice

**OUTCOMES**

The students should be able to

(i) Identify the use of tools, Types of joints used in welding, carpentry and plumbing
operations.
(ii) Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.
(iii) Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING PRACTICE

1. Welding
   Arc welding: Butt joints, Tee and lap joints.
2. Basic Machining
   Facing, turning, threading and drilling practices using lathe and drilling operation with vertical drilling machine.
3. Machine assembly practice
   Study of centrifugal pump
4. Study on
   a. Smithy operations - Productions of hexagonal headed bolt.

II. CIVIL ENGINEERING

1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

LIST OF EQUIPMENT AND COMPONENTS

(For a Batch of 30 Students)

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

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

TOTAL : 45

Reference:
SEMESTER-II
MAA102 ENGINEERING MATHEMATICS -II
4 CREDITS

GOAL
To create the awareness and to impart comprehensive knowledge in engineering mathematics.

OBJECTIVES
The course should enable the students to:
(i) Understand the evaluation of the double and triple integrals in Cartesian and polar forms.
(ii) Know the basics of Vector calculus.
(iii) Know Cauchy - Riemann equations, Milne - Thomson method and Conformal mapping
(iv) Grasp the concept of Cauchy's integral formula, Cauchy's residue theorem and contour integration.
(v) Know Laplace transform and inverse Laplace transform and their properties.

OUTCOME
The students should be able to:
(i) Find area as double integrals and volume as triple integrals in engineering applications.
(ii) Evaluate the gradient, divergence, curl, line, surface and volume integrals along with the verification of classical theorems involving them.
(iii) Apply analytic functions and their interesting properties in science and engineering.
(iv) Evaluate the basics of complex integration and the concept of contour integration which is important for evaluation of certain integrals encountered in practice.
(v) Have a sound knowledge of Laplace transform and its properties and their applications in solving initial and boundary value problems.

UNIT I  MULTIPLE INTEGRALS
Review: Basic concepts of integration - Standard results - Substitution methods - Integration by parts - Simple problems.

UNIT II  VECTOR CALCULUS
Review: Definition - vector, scalar - basic concepts of vector algebra - dot and cross products-properties.
Gradient, Divergence and Curl - Unit normal vector, Directional derivative - angle between surfaces-Irrotational and solenoidal vector fields. Verification and evaluation of Green's theorem – Gauss divergence theorem and Stoke's theorem. Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelepipeds.

UNIT III  ANALYTIC FUNCTIONS
Review: Basic results in complex numbers - Cartesian and polar forms - Demoivre's theorem.

UNIT IV  COMPLEX INTEGRATION
Statement and application of Cauchy's integral theorem and Integral formula - Evaluation of integrals using the above theorems - Taylor and Laurent series expansions -Singularities - Classification. Residues - Cauchy's residue theorem (without proof) - Contour integration over
unit circle and semicircular contours (excluding poles on boundaries).

UNIT V  LAPLACE TRANSFORM

Laplace transform - Conditions of existence - Transform of elementary functions - properties - Transforms of derivatives and integrals - Derivatives and integrals of transforms - Initial and final value theorems - Transforms of unit step function and impulse function - Transform of periodic functions. Inverse Laplace transform - Convolution theorem - Solution of linear ODE of second order with constant coefficients.

TOTAL: 60

Note: Questions need not be asked from review part.

TEXT BOOKS

REFERENCES

PHA101 ENGINEERING PHYSICS

L T P C
3 0 0 3

To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES
The course should enable the students to:
1. Develop strong fundamentals of properties and behaviour of the materials
2. Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3. Enable the students to correlate the theoretical principles with application oriented study of optics.
4. Provide a strong foundation in the understanding of solids and materials testing.
5. Enrich the knowledge of students in modern engineering materials.

OUTCOME
The students should be able to:
1. Understand the properties and behaviour of materials.
2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
3. Understand the concept, working and application of lasers and fiber optics.
4. Know the fundamentals of crystal physics and non destructive testing methods.
5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER

Elasticity - types of moduli of elasticity - Stress-Strain diagram - Young's modulus of elasticity
Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever -
Young's modulus by cantilever - uniform and non-uniform bending - viscosity - Ostwald's viscometer - comparison of viscosities.

UNIT II ACOUSTICS AND ULTRASONICS 9
Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriiction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal ( Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS 9

UNIT IV CRYSTAL PHYSICS AND NON-DESTRUCTIVE TESTING 9
Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.
Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS 9

TOTAL : 45

TEXT BOOKS

REFERENCES
5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India,
To impart basic principles of chemistry for engineers.

OBJECTIVES
The course should enable the students to
1. Make the students conversant with the basics of (a) Water technology and (b) Polymer science
2. Provide knowledge on the requirements and properties of a few important engineering materials.
3. Educate the students on the fundamentals of corrosion and its control.
4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. Create an awareness among the present generation about the various conventional energy sources.

OUTCOME
The students should be able to
1. Gain basic knowledge in water analysis and suitable water treatment method.
2. Get an idea on the type of polymers to be used in engineering applications.
3. Get awareness about new materials
4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY
Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.
Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples

UNIT II ENGINEERING MATERIALS
Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION
Conductometric Titration - HClvsNaOH and mixture of acids vsNaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage ( definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) -
Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion, examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design - Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS

UNIT V FUELS AND ENERGY SOURCES

TOTAL : 45

TEXT BOOKS

CYA102 ENVIRONMENTAL SCIENCES
3 CREDITS

GOAL
To impart basic knowledge on the significance of environmental science for engineers.

OBJECTIVES
The course should enable the students to:
(i) Make the students aware of the existing natural resources such as forest and water resources. To educate them to understand the need for preserving the resources.
(ii) Educate the students about the functions of various ecosystems and biodiversity.
(iii) Provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.
(iv) Give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts.
(v) To create an awareness among the present generation about the various aspects of human population and their effect on environment.

OUTCOME
The students should be able to:
(i) The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
(ii) Knowledge on the functions of several ecosystems will help the students to design the processes that are eco friendly.
(iii) Knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.

(iv) Exposure on the issues such as global warming, acid rain, ozone layer depletion, and nuclear hazards will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.

(v) Educating on the various aspects of population explosion will create awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance - Need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to Biodiversity - Definition: genetic, species and ecosystem diversity - Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hotspots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Field study of common plants, insects, birds Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION

Definition - Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - Soil waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster management: floods, earthquake, cyclone and landslides.

Field Study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns, case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL : 45

TEXT BOOKS

REFERENCES

EEB101 CIRCUIT THEORY  4 CREDITS

PREREQUISITE
MAA101 - Engineering Mathematics - I
MAA102 - Engineering Mathematics -II

GOAL
To provide knowledge about the application of mathematical concepts in analyzing circuits.

OBJECTIVES
The course will enable the students to:
(i) Get exposed to the basic laws in circuit analysis
(ii) Acquire adequate knowledge about the network theorems in dc and ac circuits.
(iii) Acquire knowledge about resonance and coupled circuits.
(iv) Get adequate knowledge about laplace transform in transients
(v) Get adequate knowledge about three phase circuits

OUTCOME
The students should be able to:
(i) Apply laplace transform in analyzing the circuits.
(ii) Apply theorem to find voltage, current and power through any element.
(iii) Solve competitive technical questions.
(iv) Gain knowledge about the resonance circuits.
(v) Gain knowledge about the design of electrical circuits.

UNIT I BASIC CIRCUIT ANALYSIS

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

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

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

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

L = 45 T = 15 TOTAL = 60

TEXT BOOKS

REFERENCES

EEB102 ELECTRONIC DEVICES

3 CREDITS

PREREQUISITE
PHA101 - Engineering Physics
CYA101 - Engineering Chemistry

GOAL
To Provide Basic Knowledge About Various Semiconductor Devices and their Applications.
OBJECTIVES
To acquaint the students with construction, theory and characteristics of the following electronic devices
(i)  P-N junction diode
(ii) Bipolar transistor
(iii) Field effect transistor
(iv) LED, LCD and other photo electronic devices
(v)  Power control/regulator devices

OUTCOME
The students should be able to:
(i) Understand the operation of P-N junction diode and Zener diode
(ii) Understand the operation of BJT and FET, its biasing and input-output characteristics of different configurations
(iii) Understand the principle of photo emissivity, photo conductivity and different photo electronic devices
(iv) Use of P-N diode and BJT in switching applications in designing signal conditioning circuits
(v)  Perform laboratory experiments on the mentioned different electronic devices.

UNIT I SEMICONDUCTOR DIODE
Theory of p-n junction - p-n junction as diode - p-n diode currents - Volt-amp characteristics - Diode resistance - Temperature effect of p-n junction - Transition and diffusion capacitance of p-n diode - Diode switching times.

UNIT II BI-POLAR TRANSISTOR
Junction transistor - Transistor construction - Detailed study of currents in transistor - Input and output characteristics of CE, CB and CC configurations - Transistor hybrid model for CE configuration - Analytical expressions for transistor characteristics - Transistor switching times - Voltage rating - Power transistors.

UNIT III FIELD EFFECT TRANSISTORS
Junction field effect transistor - Pinch off voltage - JFET volt-ampere characteristics - JFET small signal model - MOSFETS and their characteristics - FET as a variable resistor - Unijunction transistor.

UNIT IV OPTO ELECTRONIC DEVICES
Photo emissivity and photo electric theory - Theory, construction and characteristics. Light emitting diodes, liquid crystal cell, seven segment display, photo conductive cell, photodiode, solar cell, photo transistor, opto couplers and laser diode.

UNIT V MISCELLANEOUS DEVICES
Theory, characteristics and application: SCR, TRIAC, PUT, tunnel diode, thermistors, piezoelectric devices, zener diode, charge coupled devices, varactor diode and LDR.

L = 45  TOTAL = 45

TEXT BOOKS
REFERENCES

ELA102-Personality Development and Soft Skills

L  T  P  C
3  0  0  3

GOAL
- To enhance holistic development of students and improve their employability skills.
- To nurture the language skills and cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning.
- To help them become responsible members or leaders of the society in and around their workplace or living space.
- To communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES
The course should enable the students to:
1. Develop interpersonal skills and be an effective goal oriented team player.
2. Develop professionals with idealistic, practical and moral values.
3. Develop communication and problem solving skills.
4. To face the challenges in the world and enable the students excel in the world of work and life.

OUTCOME
The students should be able to:
1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
4. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.
5. Make right decisions, communicate effectively, and develop self-management talents, to lead a healthy and productive life.
6. Imbibe the requisite employability skills, learned skills, intuitive skills and people skills.

UNIT I SPEAKING SKILLS
Art of Speaking- Body Language and speaking- Non Verbal communication- Vocal Communication Techniques- Intercultural communication- The difference in Approach in five countries- Vocabulary Enrichment- Pronunciation of words-Mark the stress on appropriate syllable-split the word into syllables- Speaking as an Art-Simple Oral Interaction-Body Language and Speaking- Five characteristics of an ideal GD- group discussions - role plays- short speeches-Extempore – JAM –Debate-Talk shows-Power point presentation and speaking.
UNIT II LANGUAGE SKILLS
12 hours
Functional Grammar: Synonyms and Antonyms – Active and Passive Voice- Direct and Indirect Speech- Conditional Clauses- collocations- rearrange the jumbled sentences and make meaningful sentences- Language functions: apologising, greeting, clarifying, inviting, advising, agreeing, disagreeing, refusing, thanking, interrupting, expressing obligation, expressing preferences, CV / application letters- Job interviews-FAQ’s – e-mail etiquette

UNIT III PEOPLE SKILLS/ SOFT SKILLS
8 hours
SWOT analysis- JOHARI window- Goal setting- speaking on Goals - goals to be achieved-modes of behaviour to achieve the goals- decision making- time management -stress management- power of positive attitude- leadership skills

UNIT IV COMPREHENSION SKILLS
7 hours
Art of Listening- listening to English news- listening to debates on current issues - Listening to dialogues for general meaning and specific information- listening to toast master speeches- cloze exercises-open comprehension questions-Art of Listening-Reading passages –interpreting in own words- reading articles in magazines/journals/newspapers- writing articles for newspaper-reporting events-completing the middle/end of a story

UNIT V PERSONALITY DEVELOPMENT
9 hours
Define Personality- Types of Personality-Personality test- Leadership Skills - Interpersonal Skills- Team Work - Mind Mapping- concept maps- Study skills and techniques - Edward De Bono’s lateral thinking-exercises-questionnaires-project

TEXT BOOK:
English for Life and the workplace through LSRW&T skills by Dr. Dolly John, Pearson Publications

REFERENCES
2. Effective technical Communication, M. Ashraf Rizvi, Tata McGraw Hill Companies
3. Professional Speaking Skills, Aruna Koneru, Oxford University Press

Web links for reference for Flipped classroom sessions
1. https://owl.english.purdue.edu/exercises/28/12/33
GOAL
To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice.

OBJECTIVES
The course should enable the students to
1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of pictorial projections.
5. Introduction to Solid modeling
6. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

OUTCOME
The students should be able to
1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact
Note: Only first angle projection is to be followed

Unit I – BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES
Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning-Geometrical constructions - Scales. Introduction to plane curves like ellipse, parabola, cycloids and involutes Drafting methods - introduction to Computer Aided Drafting - Computer Hardware - Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modeling software – Geometrical Construction-Coordinate Systems/Basic Entities

Unit II – VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING
Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects.Drafting of simple Geometric Objects/Editing General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Unit III – PROJECTIONS OF POINTS, LINES, SURFACES AND SOLIDS
Introduction to Projections of points – Projections of straight lines located in first quadrant using rotating line method only – Projections of plane surfaces when the surface of the lamina is inclined to one reference plane only – Projections of simple solids when the axis of the solid is
inclined to one reference plane only – Sectioning of above solids in simple positions – Section Views. Practice includes drafting the projection of lines and solids using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning and 2D drafting.

**Unit IV GEOMETRICAL MODELING AND ISOMETRIC VIEWS** 15

**Unit V COMPUTER AIDED DESIGN AND DRAFTING** 15
Preparation of solids of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modeling software. Introduction to computer aided drafting and dimensioning using appropriate software. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting of drawing.

**TOTAL PERIODS: 75**

**TEXT BOOKS**

**REFERENCE BOOKS**
1. Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011

**Bureau of Indian Standards (BIS) for Engineering Drawing:**
PHAL31 PHYSICS LAB

1 CREDIT

OBJECTIVES
The course should enable the students to:

I. Determine the rigidity modulus of the material of a wire by Torsional Pendulum experiment
II. Find the Young's Modulus of a Non Uniform Bending material
III. Determination of thermal conductivity of a bad conductor by Lee's disc method
IV. Determination of thickness of a thin wire by Air Wedge method
V. Find the Refractive index of a prism by using Spectrometer

OUTCOME
The students should be able to:
VI. Determine the rigidity modulus of the material of a wire
VII. Determine the Young's Modulus of a Non Uniform Bending material.
VIII. Determine the thermal conductivity of a bad conductor
IX. Determine the thickness of a thin wire
X. Find the Refractive index of a prism using Spectrometer

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments</th>
<th>Batch 2</th>
<th>Batch 1</th>
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<td>Week</td>
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<td>1</td>
<td>Torsional Pendulum - Determination of rigidity modulus of the material of a wire.</td>
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<td>Non Uniform Bending - Determination of Young's Modulus.</td>
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<td>3</td>
<td>Viscosity - Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.</td>
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<td>4</td>
<td>Lee's Disc - Determination of thermal conductivity of a bad conductor.</td>
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<td>5</td>
<td>Air Wedge - Determination of thickness of a thin wire.</td>
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<td>6</td>
<td>Spectrometer - Refractive index of a prism.</td>
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<td>7</td>
<td>Semiconductor laser - Determination of wavelength of Laser using Grating.</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>No.</td>
<td>Equipment Description</td>
<td>Quantity</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Torsional Pendulum (500 gm, wt, 60 cm wire Al-Ni Alloy)</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Travelling Microscope (X10)</td>
<td>15 nos.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Capillary tube (length 10cm, dia 0.05mm)</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Magnifying lens (X10)</td>
<td>15 nos.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lee's disc apparatus (std form)</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Stop watch (+/- 1 s)</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Meter scale 1m length</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Spectrometer (main scale 360 deg, ver 30&quot;)</td>
<td>5 nos.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Grating (2500 LPI)</td>
<td>5 nos.</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL**

| 7   | 7   |

21 Periods
REFERENCES


CYA131 CHEMISTRY LAB

1 CREDIT

GOAL
To impart fundamental knowledge in various chemistry experiments.

OBJECTIVES
The course should enable the students to:

I. Estimate the Commercial soda by acid-base titration
II. Determine the Percentage of nickel in an alloy
III. Determine the Temporary, permanent and total hardness of water by EDTA method
IV. Determine the Chloride content in a water sample
V. Do Conductometric Titration of mixture of acids
VI. Determine the Degree of polymerization of a polymer by Viscometry

OUTCOME
The students should be able to:

I. Estimate the Commercial soda by acid-base titration
II. Determine the Percentage of nickel in an alloy
III. Determine the Temporary, permanent and total hardness of water by EDTA method
IV. Determine the Degree of polymerization of a polymer by Viscometry.
# LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments (Any Five)</th>
<th>Batch 1</th>
<th>Batch 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Week allotted</td>
<td>Periods allotted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>Estimation of Commercial soda by acid-base titration</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Determination of Percentage of nickel in an alloy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Determination of Temporary, permanent and total hardness of water by EDTA Method</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Determination of Chloride content in a water sample</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Potentiometric Estimation of iron</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Conductometric Titration of a strong acid with a strong base</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Conductometric Titration of mixture of acids.</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Determination of Degree of polymerization of a polymer by Viscometry</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>24</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>
### LIST OF GLASSWARE AND EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Burette (50 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>2</td>
<td>Pipette (20 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>3</td>
<td>Conical Flask (250 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>4</td>
<td>Distilled water bottle (1 L)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>5</td>
<td>Standard flask (100 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>6</td>
<td>Funnel (small)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>7</td>
<td>Glass rod 20 cm length</td>
<td>30 nos.</td>
</tr>
<tr>
<td>8</td>
<td>Reagent Bottle (250 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>9</td>
<td>Reagent Bottle (60 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>10</td>
<td>Beaker (100 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>11</td>
<td>Oswald Viscometer Glass</td>
<td>30 nos.</td>
</tr>
<tr>
<td>12</td>
<td>Measuring Cylinder (25 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>13</td>
<td>Digital Conductivity Meter PICO make</td>
<td>8 nos.</td>
</tr>
<tr>
<td>14</td>
<td>Conductivity cell (K=1)</td>
<td>12 nos.</td>
</tr>
<tr>
<td>15</td>
<td>Digital Potentiometer PICO make</td>
<td>8 nos.</td>
</tr>
<tr>
<td>16</td>
<td>Calomel Electrode Glass</td>
<td>12 nos.</td>
</tr>
<tr>
<td>17</td>
<td>Platinum Electrode Polypropylene</td>
<td>12 nos.</td>
</tr>
<tr>
<td>18</td>
<td>Burette Stands Wooden</td>
<td>30 nos.</td>
</tr>
<tr>
<td>19</td>
<td>Pipette stands Wooden</td>
<td>30 nos.</td>
</tr>
<tr>
<td>20</td>
<td>Retard stands Metal</td>
<td>30 nos.</td>
</tr>
<tr>
<td>21</td>
<td>Porcelain Tiles White</td>
<td>30 nos.</td>
</tr>
<tr>
<td>22</td>
<td>Clamps with Boss heads Metal</td>
<td>30 nos.</td>
</tr>
</tbody>
</table>

**TOTAL : 24**

### References
GOAL
To provide knowledge of basic engineering concepts.

OBJECTIVES
The course should enable the students:
(i) To impart knowledge on basic engineering concepts.

OUTCOME
The students should be able to:
(i) To learn how to use Electrical and Electronics tools.

LIST OF EXPERIMENTS

S.No. | LIST OF EXPERIMENTS | No. of Hours
--- | --- | ---
1. | Wiring for a tube light. | 6
2. | Wiring for a lamp and fan. | 6
3. | Staircase wiring | 3
4. | Study of (i) Iron box and (ii) Fan with Regulator | 6

Electronics Engineering
5. | Study of Electronic components and Equipments | 3
6. | Characteristics of PN junction diode & measurement of Ripple factor of half wave and full wave rectifier. | 9
7. | Applications of OP-AMP - Inverter, Adder and Subtractor. | 9
8. | Study and verification of Logic Gates | 3

TOTAL : 45

Components Required:

Electrical Engineering
- Choke: 2 nos
- Starter: 2 nos
- Tubelight stand: 2 nos
- 36W tubelight: 2 nos
- Fan: 2 nos
40W lamp 5nos
Single way switch 10 nos
Two way switch 5 nos
Iron box 2nos
Fan with regulator opened (demo purpose) 1no
Connecting Wires as required

Electronics Engineering
IC Trainer Kit, Resistors, Capacitors, CRO, Function Generator, BreadBoard, Regulated Power Supply, Zener Diode, PN Junction Diode, Potentiometer, Digital Multimeter, Ammeter, Voltmeter, Wattmeter, IC 7408, IC 7432, IC 7486, IC 7400, IC 7404, IC 7402

Text Book

EEB131 CIRCUIT THEORY LABORATORY
1 CREDIT

COREQUISITE
EEB101 - Circuit Theory

GOAL
To provide practical knowledge in Circuit Analysis

OBJECTIVES
The course should enable the students to:
I. Basic Circuit laws: ohms and Kirchhoff's law
II. Thevenin's and Norton's Theorem
III. Maximum power transfer and superposition theorem
IV. Mesh and nodal analysis
V. Transient and frequency response
VI. Series and parallel resonance
VII. Basic inductance circuits

OUTCOME
The students should be able to:
(i) Analyze basic laws in circuit analysis like KCL, KVL and ohms law
(ii) Analyze various network theorems
(iii) Analyze mesh and nodal analysis
(iv) Analyze transient and frequency response
(v) Analyze resonance and inductance circuit

LIST OF EXPERIMENTS
S.No. List of Experiments
1 Verification of ohm's law and Kirchoff's laws.
2 Verification of Thevenin's and Norton's Theorem
3 Verification of superposition Theorem
Verification of maximum power transfer theorem.

Verification of mesh and nodal analysis.

Transient response of RL and RC circuits for DC input.

Frequency response of series and parallel resonance circuits.

Frequency response of single tuned coupled circuits.

Repeat classes

Model Exam

P:45, TOTAL:45

LIST OF EQUIPMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>EQUIPMENT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regulated Power Supply</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Function Generator</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>CRO</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Bread Board</td>
<td>15 Nos.</td>
</tr>
<tr>
<td>5</td>
<td>Voltmeter of different ranges</td>
<td>10 Nos.</td>
</tr>
<tr>
<td>6</td>
<td>Milli Ammeter of different ranges</td>
<td>13 Nos.</td>
</tr>
<tr>
<td>7</td>
<td>Resistor of various ranges</td>
<td>50 Nos.</td>
</tr>
<tr>
<td>8</td>
<td>Inductor of various ranges</td>
<td>10 Nos.</td>
</tr>
<tr>
<td>9</td>
<td>Capacitor of various values</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>8</td>
<td>SPST</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Autotransformer</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Stop Watch</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>Connecting Wires</td>
<td>Sufficient Numbers</td>
</tr>
</tbody>
</table>
SEMESTER-III

MAA202 ENGINEERING MATHEMATICS – III
(Common to ECE, E&I and EEE Branches)

UNIT – I: Partial Differential Equations
Formation of partial differential equation differential equations by elimination arbitrary constant arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT – II: Boundary Value Problems
Classification of second order linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equations (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT – III: Fourier Transform

UNIT – IV: Z – Transform and Difference Equations

UNIT V: BESSEL FUNCTIONS
Bessel's equation, Bessel functions, recurrence relations, orthogonality property, generating function, equations reducible to Bessel's equation.

Total: 60

Text Books

References
EEB201 ELECTROMAGNETIC THEORY

PREREQUISITE
EEB101 - Circuit Theory,
MA A102- Engineering Mathamatics - II

GOAL
To provide knowledge about the application of mathematical concepts in electromagnetic fields and waves.

OBJECTIVES
The course will enable the students to:
(i) Understand the concepts of vectors, curl and divergence
(ii) Acquire adequate knowledge about the electric potential and the electric field intensity
(iii) Acquire knowledge about the magnetic potential and the magnetic field intensity
(iv) Get adequate knowledge about Maxwell's equation
(v) Get adequate knowledge about waves through different media

OUTCOME
The students should be able to:
(i) Apply vectors in analyzing the electromagnetic fields
(ii) Understand the various aspects of electrostatics.
(iii) Understand the various aspects of magnetostatics
(iv) Gain knowledge about Electrodynamic fields.
(v) Gain knowledge in wave propagation in different media

UNIT I  INTRODUCTION 8
Sources and effects of electromagnetic fields - Vector fields - Different co-ordinate systems - Divergence theorem - Stokes theorem.

UNIT II  ELECTROSTATICS 16
Coulomb's Law - Electric field intensity - Field due to point and continuous charges - Gauss's law and application - Electrical potential - Electric field and equipotential plots - Electric field in free space, conductors, dielectric - Dielectric polarization, Electric field in multiple dielectrics - boundary conditions, Poisson's and Laplace's equations - Capacitance-energy density - Dielectric strength.

UNIT III MAGNETOSTATICS 12

UNIT IV ELECTRODYNAMIC FIELDS 12
Faraday's laws, induced emf - Transformer and motional EMF, Maxwell's equations (differential and integral forms) - Displacement current - Relation between field theory and circuit theory.

UNIT V ELECTROMAGNETIC WAVES 12
Generation - Electro Magnetic Wave equations - Wave parameters; velocity, intrinsic
impedance, propagation constant - Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting vector - Plane wave reflection and refraction.

L = 45  T = 15  TOTAL = 60

TEXT BOOKS

REFERENCES

EEB 202 ELECTRICAL MACHINES - I

PREREQUISITE
EEB101- Circuit Theory,
EEB201 – Electromagnetic Theory

GOAL
To expose the students to the concepts of various types of DC Machines and Transformers.

OBJECTIVES
The course will enable the students to understand:
(i) Electro-mechanical energy conversions in D.C. machines and energy transfer in transformers
(ii) Constructional details, principle of operation, characteristics and performance of D.C. generator.
(iii) Constructional details, principle of operation, characteristics and speed control of D.C. motors.
(iv) Constructional details and principle of operation and performance of transformer
(v) Testing of D.C. machines and transformer

OUTCOME
The students should be able to:
(i) Understand Various types, Principle of Operation and Characteristics of DC Motors and DC Generators.
(ii) Understand Principle of Operation, types, Characteristics and parallel operation of DC Generators.
(iii) Understand Principle of Operation, types, Characteristics and speed control of DC Motors.
(iv) Understand Construction and Principle of Operation, Testing, Regulation , equivalent circuit of Transformers
(v) Understand Various direct and indirect test methods to find the efficiency of DC machines and transformer.
UNIT I BASIC CONCEPTS OF ROTATING MACHINES
Principles of electromechanical energy conversion - Single and multiple excited systems - m.m.f of distributed A.C. windings - Rotating magnetic field - Generated voltage - Torque in round rotor machine.

UNIT II DC GENERATORS
Constructional details - emf equation - Methods of excitation - Self and separately excited generators - Characteristics of series, shunt and compound generators - Armature reaction and commutation - Parallel operation of DC shunt and compound generators.

UNIT III DC MOTORS
Principle of operation - Back emf and torque equation - Characteristics of series, shunt and compound motors - Starting of DC motors - Types of starters - Speed control of DC series and shunt motors.

UNIT IV TRANSFORMERS
Constructional details of core and shell type transformers - Types of windings - Principle of operation - emf equation - Transformation ratio - Transformer on no-load - Parameters referred to HV / LV windings - Equivalent circuit - Transformer on load - Regulation - Parallel operation of single phase transformers - Auto transformer - Three phase transformers - Vector group.

UNIT V TESTING OF DC MACHINES AND TRANSFORMERS
Losses and efficiency in DC machines and transformers - Condition for maximum efficiency - Testing of DC machines - Brake test, Swinburne's test, Retardation test and Hopkinson's test - Testing of transformers - Polarity test, load test, open circuit and short circuit tests - All day efficiency.

Note: Unit 5 may be covered along with Unit 2, 3, and 4.

TEXT BOOKS

REFERENCES
PREREQUISITE
EE B102 - Electronic Devices

GOAL
To provide knowledge in the analysis and design of amplifiers and their applications.

OBJECTIVES
The course will enable the students:
(i) To get exposed to the analysis and design of small signal and larger signal amplifiers.
(ii) To make students familiar with common mode and differential mode analysis of differential amplifier.
(iii) Study the characteristics and construction of tuned amplifiers.
(iv) To get exposed to negative feedback amplifiers and oscillators.
(v) To familiarize the students with the applications such as wave form generation, clippers and clammers etc.,

OUTCOME
The students should be able to:
(i) Analyze and design small signal and large signal amplifiers.
(ii) Analyze and design Differential amplifiers and to explain the working of tuned amplifiers.
(iii) Explain the different type of negative feedback amplifiers and oscillator circuits with their design equations.
(iv) Enumerate the points on wave form generation, clipper and clamper applications using transistors and diodes.
(v) Explain the operation of Rectifiers and power supply circuits.

UNIT I SMALL-SIGNAL AND LARGE SIGNAL AMPLIFIERS 9

UNIT II DIFFERENTIAL AND TUNED AMPLIFIERS 9

UNIT III FEEDBACK AMPLIFIER AND OSCILLATORS 9
Characteristics of negative feedback amplifiers - Voltage / Current, series/shunt feedback - Theory of sinusoidal oscillators - Phase shift and Wien bridge oscillators - Colpitts, Hartley and crystal oscillators.

UNIT IV PULSE CIRCUITS 9
RC wave shaping circuits - Diode clammers and clippers - Multivibrators - Schmitt triggers - UJT based sawtooth oscillators.

UNIT V RECTIFIERS AND POWER SUPPLY CIRCUITS 9
Halfwave & fullwave rectifier analysis - Inductor filter - Capacitor filter - Series voltage regulator - Switched mode power supply.
TEXT BOOKS

REFERENCES

EEB204 MEASUREMENTS AND INSTRUMENTATION

PREREQUISITE
EE B101 - Circuit Theory
EE B203 - Electronic Circuits

GOAL
To learn how to design accurate meters with high precision and small size.

OBJECTIVES
The course will enable the students :

(i) To get the knowledge of various electrical instruments
(ii) To know how to improve the accuracy of instruments
(iii) To know about the calibration and measurements
(iv) To know about the digital instruments
(v) To know about various types of transducers.

OUTCOME
The students should be able to:

(i) Gain knowledge of various electrical instruments.
(ii) Analyze the accuracy of instruments.
(iii) Analyze various types of AC and DC bridges.
(iv) Know the principle of operation of various types of transducers.

UNIT I INTRODUCTION
Functional elements of an instrument - Static and dynamic characteristics - Errors in measurement - Statistical evaluation of measurement data - Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS
Principle and types of analog and digital voltmeters, ammeters, multimeters - Single and three phase wattmeters and energy meters - Magnetic measurements - Determination of B-
H curve and measurements of iron loss - Instrument transformers - Instruments for measurement of frequency and phase both analog and digital

UNIT III MEASUREMENTS USING COMPARISON
9
D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges.

UNIT IV STORAGE AND DISPLAY DEVICES
9
Magnetic disk and tape - Recorders, FM recording, PDM recording, digital tape recording, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display.

UNIT V TRANSDUCERS
9
Classification of transducers - Selection of transducers - Resistive, capacitive & inductive transducers - Piezoelectric, optical and digital transducers - LVDT, Thermocouples, Hall effect transducers, Non electrical measurements - Displacement, pressure, strain.

L = 45  TOTAL = 45

TEXT BOOKS

REFERENCES

SSA231 APTITUDE – I

PURPOSE:
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES
1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:
The entire program is designed in such a way that every student will participate in the classroom activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

LOGICAL REASONING:
Number, Letter series, Analogies - Coding, Decoding – Blood relations, direct sense,
Operator based questions – Clock & Calendars
Distribution, Binary Logic and Puzzles – Arrangements, Selections.
Routes & Networks, Comparison – Cubes & Venn Diagrams.

VERBAL ABILITY:
Critical Reasoning – Antonym, Synonym
Odd man – fill in the blank
Sentence Construction / Completion – Idiomatic expression
Detection of errors.
Jumbled sentences, Vocabulary, Alphabetical sequence, cloze passage.

EVALUATION:
1. University Theory Question paper
2. Activities assessed by both group and individual participation
3. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:
Complete internal evaluation on regular basis.

EED251 ELECTRICAL DRIVES AND CONTROL
(Common to Mechanical and Production)

Objectives:
To make the understanding of different speed controlling methods applied to motors

OUTCOME:
1. To understand the speed torque characteristics of motor
2. To apply modern speed control techniques to the motor

INTRODUCTION
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives
– heating and cooling curves – Loading conditions and classes of duty – Selection of power
rating for drive motors with regard to thermal overloading and Load variation factors.

DRIVE MOTOR CHARACTERISTICS
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive
motors – Braking of Electrical motors – DC motors: Shunt, series and compound –
single phase and three phase induction motors.

STARTING METHODS
Types of D.C Motors starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system – Using controlled rectifiers and DC choppers – applications.

CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TEXT BOOKS

REFERENCES

EEB231 ELECTRICAL MACHINES LABORATORY-I

CO-REQUISITE
EE B 202 - Electrical Machines - I

GOAL
To expose the students to the basic operation in electrical machines and help them to develop experimental skills.

OBJECTIVES
The course should enable the students to :
(i) Study practically DC machines and transformers by direct loading.
(ii) Study practically DC machines and transformers by indirect methods.

OUTCOME
The students should be able to:
(i) Understand the operation of DC machines and Transformers .
(ii) Analyze the performance under varying load conditions.

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction</td>
<td>3</td>
</tr>
</tbody>
</table>
1. Open circuit and load characteristics of separately excited and self excited D.C. generator 6
2. Load test on D.C. shunt motor 3
3. Load test on D.C. series motor 3
4. Speed Control of DC Shunt Motor 3
5. Swinburne’s test and speed control of D.C. shunt motor 3
6. Load test on single phase transformer and open circuit and short circuit test on single phase transformer 3
7. Hopkinson's Test 3
8. Sumpner's test 3
9. Load test on DC Compound motor 3
10. Load test on DC compound generator 3
11. Study of D.C. motor and induction motor starters 3
   Repeat Class 3
   Model Exam 3

\[
P = 45 \text{ TOTAL} = 45
\]

**LIST OF EQUIPMENT**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>D.C.motor-Shunt Generator</td>
<td>2set</td>
</tr>
<tr>
<td>5.</td>
<td>Single phase transformers</td>
<td>7Nos.</td>
</tr>
<tr>
<td>6.</td>
<td>Three phase transformers</td>
<td>2Nos.</td>
</tr>
<tr>
<td>11.</td>
<td>Resistive load 3 phase-2,single phase-3</td>
<td>5Nos.</td>
</tr>
<tr>
<td>14.</td>
<td>Three phase Autotransformer</td>
<td>3Nos.</td>
</tr>
<tr>
<td>15.</td>
<td>Moving Coil Ammeter of different ranges</td>
<td>20Nos.</td>
</tr>
<tr>
<td>16.</td>
<td>Moving Coil Voltmeter of different ranges</td>
<td>20Nos.</td>
</tr>
<tr>
<td>17.</td>
<td>Moving Iron Ammeter of different ranges</td>
<td>20Nos.</td>
</tr>
<tr>
<td>18.</td>
<td>Moving Iron voltmeter of different ranges</td>
<td>20Nos.</td>
</tr>
<tr>
<td>19.</td>
<td>Wire wound rheostats of different ratings</td>
<td>30Nos.</td>
</tr>
<tr>
<td>20.</td>
<td>Tachometers</td>
<td>10Nos.</td>
</tr>
</tbody>
</table>
PREREQUISITE / CO REQUISITE
EE B 102 - Electronic Devices
EE B 203 - Electronic Circuits

GOAL
To expose the students to study the characteristics and to determine the device parameters of various solid-state devices.

OBJECTIVES
The course should enable the students to:
(i) Obtain the performance characteristics of various solid state devices.
(ii) Construct and obtain the performance parameters of Oscillator circuits, Rectifier circuits, Amplifier circuits using solid state devices

OUTCOME
The students should be able to:
(i) Understand the performance of various solid state devices.
(ii) Understand the working of Oscillator circuits, Rectifier circuits and Amplifier

List of Experiments

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Title of Experiments</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Static Characteristics of transistor under CE, CB, CC and determination of hybrid parameters.</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Static characteristics and parameter determination of JFET.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Static characteristics of semiconductor diode, zener diode and study of simple voltage regulator circuits.</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Static characteristics of UJT and its application as a relaxation oscillator.</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Photodiode, Phototransistor characteristics and study of light activated relay circuit.</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Static characteristics of Thermistors.</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Single phase half wave and full wave rectifiers with inductive and capacitive filters.</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Phase shift oscillators and Wien bridge oscillators.</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Frequency response of common emitter amplifiers.</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Differential amplifiers using FET.</td>
<td>3</td>
</tr>
</tbody>
</table>

P : 45 TOTAL : 45
<table>
<thead>
<tr>
<th>S.No</th>
<th>Component</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transistor</td>
<td>BC 107/108, BC548, BFW11/10, 2N2646</td>
<td>Each 5</td>
</tr>
<tr>
<td>2</td>
<td>Resistor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1k Ω</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>330 Ω, 470 Ω, 68k Ω</td>
<td>Each 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.2k Ω</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100k Ω</td>
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<td>56 Ω, 47 Ω</td>
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<td>4.7k Ω</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>6.8k Ω, 27k Ω, 3.3k Ω</td>
<td>Each 1</td>
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<tr>
<td></td>
<td></td>
<td>5.6k Ω, 47k Ω, 3.9k Ω, 15k Ω</td>
<td>Each 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 Ω</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Potentiometer</td>
<td>10k Ω</td>
<td>1</td>
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<td>4</td>
<td>Capacitor</td>
<td>0.1µF</td>
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<td>0.01 µF</td>
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<td>2.2 µF</td>
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<td>22 µF</td>
<td>2</td>
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<tr>
<td>5</td>
<td>Inductor</td>
<td>100mH</td>
<td>1</td>
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<tr>
<td>6</td>
<td>Diode</td>
<td>IN4001/4007</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Regulated power supply</td>
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<tr>
<td>8</td>
<td>Ammeter</td>
<td>(0-15) µA</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0-30) mA</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0-1)mA</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0-500)µA</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Voltmeter</td>
<td>(0-1)V</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0-30)V</td>
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<td>10</td>
<td>Photodiode</td>
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<tr>
<td>11</td>
<td>Phototransistor</td>
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</tr>
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Eeb233 Measurements and Instrumentation Laboratory

CO REQUISITE
EE B 204 - Measurements and Instrumentation

GOAL
To familiarize the students with different measuring instruments and digital simulation of linear systems

OBJECTIVES
The course should enable the students to:
(i) Bridges, amplifiers and calibration of current transformers.
(ii) Digital simulation of linear systems

OUTCOME
The students should be able to:
(i) Understand the functioning Bridges, amplifiers and calibration of current transformers.
(ii) Obtain the characteristics of linear systems using digital simulation.

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction Class</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>DC Bridges i) Wheastones bridge</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>i) kelvin's double bridge</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>AC Bridges i) Anderson bridge</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>ii) schering bridge</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Instrumentation amplifiers</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Study of Transients</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Calibration of 1-phase energy meter</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Description</td>
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</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>Calibration of current transformers</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Study of Synchros</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Digital simulation of linear first order for step input</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Digital simulation of linear second order for step input</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Voltage measurement using LVDT</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Digital simulation of instrumentation amplifier</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>Digital simulation of RC transient circuit</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Model lab test</td>
<td>3</td>
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</tbody>
</table>

**P : 45 TOTAL : 45**
GOAL
To create the awareness and comprehensive knowledge in numerical solutions.

OBJECTIVES
The course should enable the students to:
(i) Learn the techniques of solving the algebraic and transcendental equations.
(ii) Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals.
(iii) Understand the use of numerical differentiation and to find the approximate area using numerical integration.
(iv) Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.
(v) Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

OUTCOME
The students should be able to:
(i) Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.
(ii) Solve problems where huge amounts of experimental data are involved; the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
(iii) Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
(iv) Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of one independent variable.
(v) Solve the initial and boundary value problems related heat flow, one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

UNIT II INTERPOLATION AND APPROXIMATION
Interpolation - equal intervals - Newton's forward and backward difference formulae - problems. Interpolation-unequal intervals - Newton's divided difference formula -
UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation - Newton's forward and backward difference - Divided differences and finite differences - Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules. Two and Three point Gaussian quadrature formulae - Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS


UNIT V INITIAL AND BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution of second order ordinary differential equation - classification of partial differential equations - Finite difference solution of two dimensional heat flow equations Laplace and Poisson equations. One dimensional heat equation by explicit and implicit methods - One dimensional wave equation.

TEXT BOOKS

REFERENCES
(i) Understand the construction and operation of synchronous generator

(ii) Understand the construction and operation and torque equation of synchronous motor.

(iii) Understand the construction and operation of three phase induction motor.

(iv) Understand various types of starters and speed control of three phase induction motor.

(v) Understand the construction and operation of single phase induction motor and the special machines.

OUTCOME
The students should be able to:

(i) Explain the concept of synchronous generator and their performance characteristics.

(ii) Explain the concept of V-curves and power developed.

(iii) Explain the concept, losses and circle diagram of three phase induction motor.

(iv) Explain the concept of starter and speed control of three phase induction motor.

(v) Explain the concept of equivalent circuit and no load and blocked rotor test and special machines.

UNIT I  SYNCHRONOUS GENERATOR

Constructional details - Types of rotors - emf equation - Synchronous reactance - Armature reaction - Voltage regulation - e.m.f, m.m.f, z.p.f and A.S.A methods - Synchronizing and parallel operation - Synchronizing torque - Change of excitation and mechanical input - Two reaction theory - Determination of direct and quadrature axis synchronous reactance using slip test - Operating characteristics - Capability curves.

UNIT II  SYNCHRONOUS MOTOR

Principle of operation - Torque equation - Operation on infinite bus bars - V-curves - Power input and power developed equations - Starting methods - Current loci for constant power input, constant excitation and constant power developed.

UNIT III  THREE PHASE INDUCTION MOTOR

Constructional details - Types of rotors - Principle of operation - Slip - Equivalent circuit - Sliptorque characteristics - Condition for maximum torque - Losses and efficiency - Load test - No load and blocked rotor tests - Circle diagram - Separation of no load losses - Double cage rotors - Induction generator - Synchronous induction motor.

UNIT IV  STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR

Need for starting - Types of starters - Stator resistance and reactance, rotor resistance, autotransformer and star-delta starters - Speed control - Change of voltage, torque, number of poles and slip - Cascaded connection - Slip power recovery scheme.

UNIT V  SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES

TEXT BOOKS


REFERENCES


EEB206 CONTROL SYSTEMS

PREREQUISITE / COREQUISITE

MA A 102 - Engineering Maths - II
EE B 202 - Electrical Machines - I
EE B 205 - Electrical Machines - II

GOAL

To familiarize the students with the basic concepts of linear control theory and design of control system.

OBJECTIVES

The course will enable the students to:

(i) Understand the methods of representation of systems and getting their transfer function models
(ii) Provide adequate knowledge in the time response of systems and steady state error analysis.
(iii) Give basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.
(iv) Understand the concept of stability of control system and methods of stability analysis.
(v) Study the three ways of designing compensation for a control system

OUTCOME

The students should be able to:

(i) Understand the various methods of representation of systems.
(ii) Apply time response analysis and to determine steady state error.
(iii) Analyse the stability of the system using frequency response plots and able to
adjust the gain of the system to satisfy the desired specifications.

(iv) Determine the stability of the system by applying various stability criteria.

(v) Design a suitable compensator to stabilize the system and to obtain the desired performance.

UNIT I  SYSTEMS AND THEIR REPRESENTATION

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. Programmable Logic Control - operation.

UNIT II  TIME RESPONSE


UNIT III  FREQUENCY RESPONSE

Frequency response - Bode plot - Polar plot - Constant M and N circles - Nichol's chart - Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications.

UNIT IV  STABILITY OF CONTROL SYSTEM

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.

UNIT V  COMPENSATOR DESIGN

Performance criteria - Lag, lead and lag-lead networks - Compensator design using bode plots.

L = 45  T = 15 TOTAL = 60

TEXT BOOKS


REFERENCES


EEB207 DIGITAL LOGIC CIRCUITS

L T P C
3 1 0 4
PREREQUISITE
EE B 203 - Electronic Circuits

GOAL
To familiarize the students with the basics of number systems, codes, Encoders, Decoders, Multiplexers, DeMultiplexers, Analysis & Design of synchronous & asynchronous sequential circuits and Programmable Logic Devices.

OBJECTIVES
(i) In Number system & Boolean algebra unit the student will be learning about the basics of number systems, codes, Simplification of functions.
(ii) In Combinational circuits unit the student will be learning about logic gates, adders, subtractors, Encoders, Decoders, Multiplexers and DeMultiplexers.
(iii) In Synchronous sequential circuits unit the student will be learning about different types of Flip Flops, Analysis & Design of synchronous sequential circuits and counters.
(iv) In Asynchronous sequential circuit unit the student will be learning about Analysis & Design of asynchronous sequential circuits
(v) In programmable logic devices, memory and logic families unit the student will be learning about different types of memories and logical families.

OUTCOME
The students should be able to:
(i) Gain knowledge about code conversions and to simplify any complex circuit.
(ii) Understand about design of adder circuit & subtractor circuit. Also he/she will be able to realize any function using multiplexers.
(iii) Design synchronous sequential circuits and counters.
(iv) Design asynchronous sequential circuits.
(v) Understand different types of memories and logical families.

UNIT I  NUMBER SYSTEM & BOOLEAN ALGEBRA  12

UNIT II  COMBINATIONAL CIRCUITS  12

UNIT III  SYNCHRONOUS SEQUENTIAL CIRCUITS  12
Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits - Counters, state diagram; state reduction; state assignment.

UNIT IV  ASYNCHRONOUS SEQUENTIAL CIRCUIT  12
Analysis of asynchronous sequential machines, state assignment, asynchronous design
problem.

UNIT V PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

\[
L = 45 \quad T = 15 \quad \text{TOTAL} = 60
\]

TEXT BOOKS


SSA232 APTITUDE – IV

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

PURPOSE:
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES

1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

**QUANTITATIVE APTITUDE:**
Sample Equation, Ratio, Proportion, Variation.
Percentage, Profit & Loss, Partnership.
Averages, Mixtures, Allegations: Simple & Compound Interest.
Time Work, Time Distance.
Geometry & Mensuration.
Permutation, Combination & Probability.
Data Interpretation & Data Sufficiency.

Analytical reasoning:
Non- Verbal Reasoning
Word problem

**EVALUATION:**
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

**SCHEME OF INSTRUCTION:**
Marks allocated for regular participation in all oral activities in class.

**SCHEME OF EXAMINATION:**
Complete internal evaluation on regular basis.

**EED252 ELECTRONICS AND MICROPROCESSORS**

**OBJECTIVE**
To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

**OUTCOME**
1. To understand the solid state devices and digital circuits
2. To understand the digital processors for hardware control

**UNIT I SEMICONDUCTORS AND RECTIFIERS**
Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation.

**UNIT II TRANSISTORS AND AMPLIFIERS**
Bipolar junction transistor - CB, CE, CC configuration and characteristics - Biasing circuits - Class A, Band C amplifiers - Field effect transistor - Configuration and characteristic of FET amplifier - SCR, Diac, Triac, UJT - Characteristics and simple applications - Switching transistors - Concept of feedback - Negative feedback - Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS

9

Binary number system - AND, OR, NOT, NAND, NOR circuits - Boolean algebra - Exclusive OR gate - Flip flops - Half and full adders - Registers - Counters - A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR

9

Block diagram of microcomputer - Architecture of 8085 - Pin configuration - Instruction set - Addressing modes - Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR

6

Basic interfacing concepts - Interfacing of Input and Output devices - Applications of microprocessor - Temperature control, Stepper motor control, traffic light control.

TOTAL : 45

PERIODS

TEXT BOOKS:

REFERENCES:

EEB234 ELECTRICAL MACHINES LABORATORY-II

COREQUISITE
EE B 205 - Electrical Machines II

GOAL
To expose the students to the basic operation in electrical machines and help them to develop experimental skills.

OBJECTIVES
The course will enable the students to:

(i) Obtain regulation of three-phase alternator and three-phase synchronous motor using various methods.
(ii) Obtain the performance characteristics of three-phase and single-phase induction motor.

**OUTCOME**

The students should be able to:

(i) Understand the regulation of three-phase alternator and three-phase synchronous motor using various methods.
(ii) Understand performance of three-phase and single-phase induction motor

**List of Experiments**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Title of Experiments</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Regulation of three phase alternator by emf methods</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Regulation of three phase alternator by mmf methods</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Regulation of three phase alternator by ZPF methods</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Regulation of three phase salient pole alternator by slip test</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>V and Inverted V curves of Three Phase Synchronous Motor.</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Load test on three-phase induction motor.</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>No load and blocked rotor test on three-phase induction motor.</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Separation of No-load losses of three-phase induction motor.</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Load test on single-phase induction motor</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>No load and blocked rotor test on single-phase induction motor.</td>
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</tr>
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<td>Repeat Class</td>
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<td></td>
<td>Model Exam</td>
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**P:45 TOTAL :45**

<table>
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<tr>
<th>S.No</th>
<th>Name of the Equipment</th>
<th>Quantity required</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>DC shunt motor coupled three phase alternator</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Synchronous motor</td>
<td>1</td>
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<tr>
<td>3.</td>
<td>Three phase induction motors-</td>
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<tr>
<td></td>
<td>Squirrel cage</td>
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<tr>
<td></td>
<td>Slipring</td>
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</tr>
<tr>
<td>4.</td>
<td>DC Shunt motor coupled salient pole three phase alternator</td>
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</tr>
<tr>
<td>5.</td>
<td>Single phase induction motors</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Air core inductor to do ZPF</td>
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</tr>
</tbody>
</table>
7. Starter-
   Three point Starters 4
   Three phase induction motor starter 4
   Single phase induction motor starter 2

8. Meters-
   Voltmeter (MI) 15
   Ammeter (MI) 15
   Voltmeter (MC) 5
   Ammeter (MC) 5
   Wattmeter (LPF) 15
   Wattmeter (UPF) 15

9. Single phase autotransformer 2
10. Three phase autotransformer 4
11. Rheostats of various range 30
12. DC panel boards (220V) 1
13. AC panel board 1
14. Tachometer 12
15. Lamp set 1
16. Frequency meter 1
To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems.

**OBJECTIVES**

The course will enable the students to

(i) Determine the transfer function parameters of AC servomotor.
(ii) Simulate type-0 and type-1 system.
(iii) Simulate linear systems and non-linear systems using digital simulation.
(iv) Design of P, PI and PID controllers.
(v) Learn Stability analysis of linear systems.

**OUTCOME**

The students should be able to:

(i) Understand the transfer function parameters for any type of system
(ii) Understand and Simulate(Digital and Analog) time response characteristics of type-0 and type-1 system
(iii) Understand and Design linear and nonlinear systems
(iv) Understand the stability Analysis of the linear system using Bode Root locus and Nyquist plot.

**LIST OF EXPERIMENTS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Determination of transfer function parameters of AC servo motor</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Determination of transfer function parameters of DC motor</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Analog simulation of Type-0 and Type-1 system</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Digital simulation of Linear system</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Digital simulation of Non-Linear system</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Design and implementation of Compensators</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Stability analysis of linear systems using Routh-Hurwitz and Root Locus method</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Stability analysis of linear systems using Bode plot and Nyquist plot method</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Design of P, PI, PID controllers</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Study of Synchros</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Repeat Class</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Model Exam</td>
<td>3</td>
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**LIST OF EQUIPMENTS**

<table>
<thead>
<tr>
<th>Sl. No. Description</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
</table>
EEB236 DIGITAL LOGIC CIRCUITS LABORATORY

COREQUISITE
EE B 207 - DIGITAL LOGIC CIRCUITS

GOAL
To expose the students to various digital logic circuits used in simple system configuration such as adder, encoder, multiplexer, counters etc.,

OBJECTIVES
The course will enable the students to:

i. Study Basic gates

ii. Implement Boolean Functions


iv. Design and Implement the following code converters
   a. BCD to XS3 Converter
   b. XS3 to BCD Converter
   c. BINARY to GRAY Converter
   d. GRAY to BINARY Converter

v. Design and Implement 4:1 multiplexer using gates

vi. Design and Implement 1:4 demultiplexer using gates
vii. Design Decoder and Encoder circuits.

viii. Design and implement 3-bit asynchronous and synchronous counters

ix. Design and implement 4-bit shift registers in SISO, SIPO, PISO, PIPO

OUTCOME
The students should be able to:

i. To analyze Basic gates

ii. To Implement of any Boolean Functions

iii. To Design of Adder and Subtractor

iv. To Implement of different code converters

v. To Implement of 4:1 multiplexer using gates

vi. To Implement of 1:4 demultiplexer using gates

vii. To analyze Decoder and Encoder circuits.

viii. To Implement of 3-bit asynchronous and synchronous counters

ix. To Implement of 4-bit shift registers in SISO, SIPO, PISO, PIPO

LIST OF EXPERIMENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Study of Basic Digital ICs. (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND)</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Implementation of Boolean Functions</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Adder/ Subtractor circuits</td>
<td>3+3</td>
</tr>
<tr>
<td>4</td>
<td>Code converters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. BCD to XS3 Converter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. XS3 to BCD Converter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. BINARY to GRAY Converter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. GRAY to BINARY Converter</td>
<td>3+3</td>
</tr>
<tr>
<td>5</td>
<td>Multiplexer : Design of 4:1 multiplexer using gates.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Study of Multiplexer IC</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Demultiplexer : Design of 1:4 demultiplexer using gates.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Study of Demultiplexer IC</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Design of Decoder and Encoder circuits</td>
<td>3+3</td>
</tr>
</tbody>
</table>
8  Study of Basic Flip Flops using gates and ICs.  
(Verification of truth table for JK Flip Flop, RS F/F, D F/F and TF/F)  3

9  Counters: Design and implementation of 3-bit asynchronous up and down counter using J-K F/F  3

10 Counters: Design and implementation of Mod 5 synchronous counter using J-K F/F  3

11 Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable ICs  3+3

P : 45 Total : 45

COMPONENTS REQUIRED

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1</td>
<td>Digital IC Trainer Kit</td>
<td>12</td>
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<tr>
<td>2</td>
<td>IC 7408, 7432, 7404, 7400, 7402, 7486</td>
<td>20</td>
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<tr>
<td>3</td>
<td>IC 7411, 7410</td>
<td>10</td>
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<tr>
<td>4</td>
<td>IC 74153, 74139</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>IC 7474, 7473</td>
<td>10</td>
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</tbody>
</table>

EEB237 DESIGN PROJECT -I

GOAL
To provide an opportunity to the students to implement the principles of engineering learnt by them in practical applications with innovative ideas and thus enable them to have a practical expos

EVALUATION PROCEDURE

<table>
<thead>
<tr>
<th>Review</th>
<th>Requirement</th>
<th>Weightage in Internal</th>
<th>Weightage in External</th>
<th>Duration</th>
</tr>
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<tbody>
<tr>
<td>Zeroth Review</td>
<td>Title selection</td>
<td>-</td>
<td>-</td>
<td>At the end of 2 week from the start of semester</td>
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<tr>
<td>First Review</td>
<td>Literature review, Proposal for the project</td>
<td>10 %</td>
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<td>At the end of 5 week from the start of semester</td>
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<tr>
<td>Event</td>
<td>Assessment</td>
<td>Weight (%)</td>
<td>Completion Date</td>
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<tr>
<td>-----------------------</td>
<td>-----------------------------------------</td>
<td>------------</td>
<td>------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Second Review</td>
<td>Mathematical Analysis and Circuit Working</td>
<td>20%</td>
<td>At the end of 8 week from the start of semester</td>
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<tr>
<td>Model Review</td>
<td>Final simulation / Hardware presentation</td>
<td>20%</td>
<td>At the end of 11 week from the start of semester</td>
<td></td>
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<tr>
<td>University Exam</td>
<td>Final Demo</td>
<td>50%</td>
<td>At the end of 12 week from the start of semester</td>
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</tbody>
</table>
SEMESTER V
EEB301 POWER ELECTRONICS

PREREQUISITE
EE B 102 - Electronic Devices
EE B 203 - Electronic Circuits
EE B 202 - Electrical Machines - I
EE B 205 - Electrical Machines - II
MA A 201 - Engineering Maths - III

GOAL
To introduce the application of electronic devices for conversion, control and conditioning of electric power.

OBJECTIVES
The course will enable the students to:
(i) Get an overview of different types of power semiconductor devices and their switching characteristics.
(ii) Understand the operation, characteristics and performance parameters of controlled rectifiers.
(iii) Study the operation, switching techniques and basic topologies of DC-DC switching regulators.
(iv) Learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction techniques.
(v) Study the simple applications.

OUTCOME
The students should be able to:
(i) Analyse the dynamic and switching characteristics of power semiconductor devices.
(ii) Determine the performance parameters of controlled rectifiers and AC voltage controller.
(iii) Design Choppers and Switching Regulators.
(iv) Understand Fixed DC to Variable AC converters, Various Modulation Techniques employed in Inverters and the Effect of Harmonics.
(v) Apply Power Converters in a Power System such as HVDC Transmission and FACTS.

UNIT I POWER SEMI-CONDUCTOR DEVICES
Structure, operation and characteristics of SCR, TRIAC, power transistor, MOSFET and IGBT. Driver and snubber circuits for MOSFET - Turn-on and turn-off characteristics and switching losses.

UNIT II PHASE-CONTROLLED CONVERTERS
2-pulse, 3-pulse and 6-pulse converters - Inverter operation of fully controlled converter - Effect of source inductance - Distortion and displacement factor - Ripple factor - Single phase AC voltage controllers.

UNIT III DC TO DC CONVERTERS
Step-down and step-up choppers - Time ratio control and current limit control - Switching mode regulators: Buck, boost, buck-boost and cuk converter - Resonant switching based SMPS.
UNIT IV INVERTERS

Single phase and three phase (both 120degree mode and 180 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM and multiple PWM - Voltage and harmonic control - Series resonant inverter - Current source inverters.

UNIT V APPLICATIONS

Uninterrupted power supply topologies - Flexible AC transmission systems - Shunt and series static VAR compensator - Unified power flow controller- HVDC Transmission.

L = 45 T=15 TOTAL = 60

TEXT BOOKS :

REFERENCES

EEB302 TRANSMISSION AND DISTRIBUTION L T P C
3 1 0 4

PREREQUISITE
EE B 201 - Electromagnetic Theory
EE B 101 - Circuit Theory
EE B 202 - Electrical Machines - I
EE B 205 - Electrical Machines - II

GOAL
The optimal goal of the course is to describe the journey of electricity from the power plant to customers.

OBJECTIVES
The course will enable the students
(i) To gain knowledge of how transmission and distribution systems deliver power from a power plant to customers.
(ii) To identify the basic components of a transmission and distribution system and explain their functions.
(iii) To gain knowledge of how power grids help in continuous flow of power to customers.
(iv) To model the transmission line with compensators.
(v) To Design Proper grounding and insulation coordination of transmission line.

OUTCOME
The students should be able to:
(i) Calculate the technical losses due to energy dissipated in the conductors and equipment.
used for transmission

(ii) Do load management and Energy audits.
(iii) Know the advantages and application of grounding system in the power system.
(iv) Gain knowledge about substations and distribution system.
(v) Establish the types of distribution systems.

UNIT I  INTRODUCTION

Structure of electric power system: Various levels such as generation, transmission and distribution; HVDC and EHV AC transmission: comparison of economics of transmission, technical performance and reliability, application of HVDC transmission system. FACTS (qualitative treatment only): TCSC, SVC, STATCOM, UPFC.

UNIT II  TRANSMISSION LINE PARAMETERS

Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition; application of self and mutual GMD; skin and proximity effects; interference with neighboring communication circuits. Typical configuration, conductor types and electrical parameters of 400, 220, 110, 66 and 33 kV lines.

UNIT III  MODELLING AND PERFORMANCE OF TRANSMISSION LINES

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge impedance loading, loadability limits based on thermal loading, angle and voltage stability considerations; shunt and series compensation; Ferranti effect and corona loss.

UNIT IV  INSULATORS AND CABLES

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance, dielectric stress and grading, thermal characteristics.

UNIT V  SUBSTATION, GROUNDING AND DISTRIBUTION SYSTEM

Types of substations: bus-bar arrangements; substation bus schemes: single bus scheme, double bus with double breaker and single breaker, main and transfer bus, ring bus, double bus-bar with bypass isolators. Resistance of grounding systems: Resistance of driven rods, resistance of grounding point electrode, grounding grids; design principles of substation grounding system; neutral grounding. Radial and ring-main distributors; interconnectors; three-phase, four-wire distribution system; sub-mains; stepped and tapered mains.

L=45  T = 15  TOTAL =60

TEXT BOOKS

REFERENCES
SSA331 PLACEMENT PREPARATORY PROGRAMME- V

L  T  P  C
1  0  1  1

PURPOSE:
The Purpose of the course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES:
At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Gain self confidence to face the placement process.

METHODOLOGY:
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities & Individual activities
2. Collaborative learning
3. Interactive Sessions
4. Ensure Participation
5. Empirical Learning

• Resume writing
• SWOT Analysis
• Interview techniques
• Presentation skills
• Body Language for Interview
• Rules of Group Discussion
• FAQs

EVALUATION:
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:
Complete Internal Evaluation on a regular Basis.
PREREQUISITE
EE B 101 - Circuit Theory
EE B 207 - Digital Logic Circuits
MA A 201 - Engineering Maths
- III

GOAL
To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain.

OBJECTIVES
The course will enable the students to:
(i) Classify signals and systems & their mathematical representation.
(ii) Analyse the discrete time systems.
(iii) Study various transformation tech-niques & their computation.
(iv) Study about filters and their design for digital implementation.
(v) Study about a programmable digital signal processor & quantization effects.

OUTCOME
The students should be able to:
(i) Understand Signals and systems & their mathematical representation.
(ii) Understand Z-transform, inverse z-transform, stability analysis
(iii) Understand DFT, FFT, DIT and DIF
(iv) Understand Various digital filter design
(v) Understand Programmable digital signal processor

UNIT I  INTRODUCTION
Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation, analog to digital conversion.

UNIT II  DISCRETE TIME SYSTEM ANALYSIS
Z-transform and its properties, inverse z-transforms; difference equation - Solution by z-transform, application to discrete systems - Stability analysis, frequency response - Convolution - Fourier transform of discrete sequence - Discrete Fourier series.
UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION

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

UNIT IV DESIGN OF DIGITAL FILTERS

FIR & IIR filter realization - Parallel & cascade forms. FIR design: Windowing Techniques - Need and choice of windows - Linear phase characteristics.

IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

UNIT V PROGRAMMABLE DSP CHIPS

Architecture and features of TMS 320C54 signal processing chip - Quantisation effects in designing digital filters.

L = 45 TOTAL = 45

TEXT BOOKS


REFERENCES


4. Texas TMS 320C54X user manual (website).

EEC351 PROTECTION & SWITCHGEAR

PREREQUISITE

EE B 302 - Transmission & Distribution

GOAL

To expose the students to various faults in power systems and the methods of detecting them; the basics of arc interruption and the various types of switchgear.

OBJECTIVES

The course will enable the students to:

(i) Study the different types of faults in a power system

(ii) Provide knowledge on different methods of earthing power system.
(iii) Give basic knowledge on different types of protective relays and their applications.
(iv) Provide the concept of arc interruption models and their application with respect to switchgear Study the various types of circuit breakers and testing

OUTCOME
The students should be able to:
(i) Apply the Symmetrical Components techniques for fault analysis.
(ii) Evolve appropriate protection schemes and select the necessary protective relays
(iii) Have adequate knowledge on circuit breakers

UNIT I INTRODUCTION 9
Principles and need for protective schemes - nature and causes of faults - types of faults - fault current calculation using symmetrical components - Power system earthing - Zones of protection and essential qualities of protection - Protection scheme.

UNIT II OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS 9
Electromagnetic relays - Over current, directional, distance and differential, under frequency relays - static relays.

UNIT III APPARATUS PROTECTION 9
Apparatus protection: transformer, generator, motor- protection of bus bars & transmission lines - CTs and PTs and their applications in protection schemes.

UNIT IV THEORY OF CIRCUIT INTERRUPTION 9

UNIT V MICRO PROCESSOR BASED RELAYS
Microprocessor control for overcurrent relay, impedance relay, direction and mho relay, digital distance relay algorithm

Text Book:
1. Badri Ram & D N Vishwakarma,”Power system protection & switch gear”
   TMH pub. 2007

EEC352 SOLAR ENERGY SYSTEMS  L P T C
Prerequisite
PH A 101- Engineering Physics
EE B 102 - Electronic Devices

Goal:
To familiarize the students with the basics of Solar Energy Technology, it's subsystems, Various Government Regulations. Also they will learning advanced topics in Solar Technology.
OBJECTIVES:
(i) In Solar Energy Technology & Engineering unit the student will be learning about different types of solar systems, tracking and storage.
(ii) In Solar Subsystems and Installation unit the student will be learning about Subsystems of PV systems, Planning of solar installation and it's monitoring and control.
(iii) In Regulations unit the student will be learning Solar Policies, Solar Purchase Obligation, Grid Parity and Energy saving and payback.
(iv) In Solar Thermal systems unit the student will be learning about Modelling of Solar Thermal Systems, Design of Active Systems, Solar Distillation and Solar Drying.
(v) In Advanced Topics in Solar Technology unit the student will be learning about Effect of Shading, integration with grid systems and Multilayered cells.

OUTCOMES:
(i) Gain Knowledge about different types of solar systems, tracker selection and storage systems.
(ii) Understand about the Subsystems of PV, it's installation and control.
(v) Understand and analyse Effect of Shading, integration with grid systems and Multilayered cells.

UNIT I: SOLAR ENERGY TECHNOLOGY AND ENGINEERING

UNIT II SOLAR SUBSYSTEMS AND INSTALLATION
Components and subsystems of PV systems, Converters, different configurations; Inverter location trade-off studies; Planning of solar installation, Conditions & limits, Yield/loss study, Yield assessment for photovoltaic systems; Monitoring and control system, connection to grid, diesel plants, other renewable sources.

UNIT III REGULATION

UNIT IV SOLAR THERMAL SYSTEMS

UNIT V ADVANCED TOPICS IN SOLAR TECHNOLOGY
Power Point Tracker for PV systems, Effect of Shading, Power Electronics for Efficient Interface; PV distributed generation units, integration with grid systems; Nano-structured solar cells; organic, hybrid, and dye-sensitized solar cells; Multilayered cells, Sunlight Concentrator; Biomimetic solar fuels.

L = 45 TOTAL = 45

TEXTBOOKS

REFERENCES

EEC353 LINEAR INTEGRATED CIRCUITS

PREREQUISITE
EE B 203 - Electronic Circuits

GOAL
To provide knowledge about the applications of op amp and Special ICs.

OBJECTIVES
The course will enable the students:

(i) To study the IC fabrication.
(ii) To study characteristics of op-Amp ICs.
(iii) To study the applications of Op-amp.
(iv) To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, Opto-electronic ICs.

OUTCOME
The students should be able to:

(i) Understand IC fabrication
(ii) Understand DC and AC characteristics analysis of different Linear Op-Amp ICs.
(iii) Understand various applications of Op-amp
(iv) Gain knowledge about IC Timers, PLL circuits and Regulator circuits

UNIT I IC FABRICATION
IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging.

UNIT II CHARACTERISTICS OF OP-AMP
Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp - summer, differentiator and integrator.

UNIT III APPLICATIONS OF OP-AMP
Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

UNIT IV SPECIAL ICs
555 Timer circuit - Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase locked loop-circuit functioning and applications, Analog multiplier ICs.

UNIT V APPLICATION ICs
IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

L = 45  TOTAL = 45

TEXT BOOKS

REFERENCES
Goal

To provide knowledge about the High Voltage DC transmission Systems

Objectives

The course will enable the students to:
1. Study the basics of dc power transmission technology and its modern trends,
2. Study the analysis of Graetz circuits for 6-pulse & 12-pulse converter characteristics,
3. Study the system control hierarchy and firing angle control.
4. Study the characteristics and non-characteristic harmonics in HVDC system and types of Filters
5. Study about the component models of AC/DC systems.

Outcomes

After completion of the course the students are expected to be able to:
1. Know the comparison of AC and DC transmission and application of HVDC transmission systems,
2. One can learn about the applications of different converter bridges,
3. Know the HVDC system control and start-stop DC link,
4. Know the different types of harmonics in HVDC system Filterstoremovethem

UNITI DC POWER TRANSMISSION TECHNOLOGY

Introduction-comparison of AC and DC transmission-application of DC transmission-description of DC transmission-system planning for HVDC transmission-modern trends in DC transmission.

UNITII ANALYSIS OF HVDC CONVERTERS

Pulse number, choice of converter configuration-simplified analysis of Graetz circuit-converter bridge characteristics-characteristic of a twelve pulse converter-detailed analysis of converters.

UNIT III CONVERGER AND HVDC SYSTEM CONTROL

General principles of DC link control-converter control characteristics-system control hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.
UNIT IV HARMONICS AND FILTERS

Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and R/I noise.

UNIT V COMPONENT MODELS FOR THE ANALYSIS OF AC/DC SYSTEMS

Converter Model-Converter Control-Modelling of DC Network-Modelling of AC Network.

Text books


Reference books


EEC355 WIND ENERGY CONVERSION SYSTEM

Goal:
To make understanding the fundamentals of wind power generation

Objectives:
1. To make understanding of wind energy concepts
2. To understand the types of wind generators
3. To make students should able to design wind power projects with cost considerations

Outcomes:
1. Students get the idea about wind speed mechanism
2. Students get the idea about wind turbines design and wind electric generators
3. Students get the idea about wind project design and economics factors

UNIT I WIND ENERGY FUNDAMENTALS

Wind energy basics, wind speeds, wind characteristics and power production, terrain
Roughness, turbulence, boundary layers, betz coefficient, limits
UNIT II AERODYNAMIC THEORY

Air foil terminology, blade element theory, blade design, number of blades, shapes, tipspeed, lift and drag ratio, rotor dynamics, types of loads, balancing technique

UNIT III WIND TURBINES & GENERATORS

Vertical axis, Horizontal axis turbines, constant speed, variable speed turbines, Pitch and yaw control, gear coupled and direct coupled generators, multipole synchronous Generators, doubly fed induction generators

UNIT IV CONCEPT OF WIND FARM AND PROJECT

Project planning, personal measurement, anemometer measurement, wind direction measurement, site selection, operation and maintenance, environmental concerns

UNIT V COST ECONOMICS

Fixed and variable costs, value of wind energy, return on investment, wind energy market, cash flow of wind power projects

L=45, Total:45

Text books

1. Freris L.L. “Wind energy conversion systems, prentice hall 1990

References

1. C-WET,” Wind energy resource survey in India VI

EED351 CONTROL ENGINEERING

L P T C
3 0 0 3

Objectives:

(i) To introduce the mathematical modeling of systems, open loop and closed loop systems and analysis in time domain and frequency domain.
(ii) To impart the knowledge on the concept of stability and various methods to analyze stability in both time and frequency domain.
(iii) To introduce sampled data control system.

Outcomes:

(i) Ability to apply mathematical knowledge to model the systems and analyse the frequency domain.
(ii) Ability to check the stability of the both time and frequency domain.
UNIT I INTRODUCTION

Historical review, Simple pneumatic, Hydraulic and thermal systems, Series and parallel system Analogies, mechanical and electrical components, Development of flight control systems.

UNIT II OPEN AND CLOSED LOOP SYSTEMS

Feedback control systems – Control system components – Block diagram representation of control systems. Reduction of block diagrams, Signal flow graphs, Output to input ratios.

UNIT III CHARACTERISTIC EQUATION AND FUNCTIONS

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT IV CONCEPT OF STABILITY

Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Rootlocus and Bode techniques, Concept and construction, frequency response.

UNIT V SAMPLED DATA SYSTEMS

Z-Transforms Introduction to digital control system, Digital Controllers and Digital PID controllers.

TOTAL = 45 PERIODS

TEXT BOOKS


REFERENCES:

EEB331 LINEAR INTEGRATED CIRCUITS LABORATORY

PREREQUISITE
EE B 101 - Circuit theory

GOAL
To make the students to understand the operation and concepts behind OP amp and to make them to develop OP amp application Circuits

OBJECTIVES
The course will enable the students:

(v) To study characteristics of op-Amp ICs.
(vi) To study the applications of Op-amp.

OUTCOME
The students should be able to:

(v) Understand DC and AC characteristics analysis of Op-Amp.
(vi) Understand and Design various Op-amp Circuits

CHARACTERISTICS OF OP-AMP

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp - summer, differentiator and integrator.

Experiments
1. Inverting, Non inverting and Differential amplifiers
2. Frequency response of an OP amp
3. Summing Amplifier
4. Integrator and Differentiator.

APPLICATIONS OF OP-AMP

First and second order active filters, Comparators, clippers, clamps, Multivibrators, waveform generators, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

Experiments
5. Active lowpass, Highpass and bandpass filters.
8. Phase shift and Wien bridge oscillators using opamp

Lecture = 24  LAB = 24  Total = 48
TEXT BOOKS

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 20 STUDENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dual ,(0-30V) variable Power Supply</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CRO</td>
<td>6</td>
<td>Minimum 20 MHz</td>
</tr>
<tr>
<td>3</td>
<td>Digital Multimeter</td>
<td>10</td>
<td>Digital</td>
</tr>
<tr>
<td>4</td>
<td>Function Generator</td>
<td>8</td>
<td>1 MHz</td>
</tr>
<tr>
<td>5</td>
<td>IC tester (analog)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bread board</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>IC 741</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Diodes,IN4001,BY126</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Zener diodes</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Potentiometer</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Step-down transformer</td>
<td>3</td>
<td>230V/12-0-12V</td>
</tr>
<tr>
<td>12</td>
<td>Capacitor Assorted</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Resistors 1/4 Watt Assorted</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>DC Voltmeter (various Ranges)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>DC Voltmeter (various Ranges)</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

EEB332 POWER ELECTRONICS LABORATORY

**COREQUISITE**
EE B 301 - Power Electronics

**GOAL**
To study the characteristics of switching devices and its applications in rectifier, inverter, chopper and resonant converter.

**OBJECTIVES**
The course will enable the students to:

(i) Obtain the characteristics of SCR, TRIAC, MOSFET, IGBT.
(ii) Obtain the characteristics of rectifiers, choppers, inverters and resonant converters.

**OUTCOME**

The students should be able to:

(i) Understand the characteristics of all the power semiconductor devices.

(ii) Analyse the performance parameters of Rectifiers, choppers and Inverters.

**LIST OF EXPERIMENTS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>List of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Characteristics of SCR</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Characteristics of TRIAC</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Characteristics of MOSFET and IGBT</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Triggering circuits for SCR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. UJT Trigger circuit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. R firing circuit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. RC Firing circuit</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Transient characteristics of SCR and MOSFET</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>AC to DC half and fully controlled converter</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Step down and step up MOSFET based choppers</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>IGBT based single-phase PWM inverter</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Zero voltage switching resonant dc-dc converter</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Zero current switching resonant dc-to-dc converter</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Revision lab &amp; Model exam</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>P : 45 TOTAL : 45</strong></td>
<td></td>
</tr>
</tbody>
</table>

**LIST OF EQUIPMENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Static characteristic module (for SCR, MOSFET, TRIAC and IGBT)</td>
<td>2 each</td>
</tr>
<tr>
<td>2</td>
<td>SCR firing circuit module</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Single phase SCR based half controlled converter &amp; fully controlled converter along with built-in separate firing circuit module and meter</td>
<td>2 each</td>
</tr>
<tr>
<td>4</td>
<td>MOSFET based step up and step down choppers</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>IGBT based single phase PWM inverter module</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Resonant DC-DC converter module with built in power supply and controller</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>SCR &amp; TRIAC based 1 phase A.C. phase controller along with lamp or rheostat load</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Dual regulated DC power supply with common ground</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Cathode Ray Oscilloscope</td>
<td>5</td>
</tr>
</tbody>
</table>
Goal:
To enable the students gain a fair knowledge on the technology used and measurements on solar PV systems

Objectives:
The course should enable the students to:

1. Measure the parameters of a solar PV Module
2. Connect the PV modules in series and parallel combinations and to measure the current-voltage (I-V) characteristics
3. Calculate the energy generated when PV modules are placed at different positions to sun rays
4. Determine the efficiency of a stand alone PV System
5. Measurement by using 4 quadrant power supply and solar cell as load and under illumination
6. Measure the open circuit voltage decay of a crystalline silicon solar cell
7. Analyse using simulation tool

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

1. Estimate the parameters like Short Circuit Current (ISC), Open Circuit Voltage (VOC) of a solar PV module.
2. Measure I-V characteristics of PV modules connected in series and parallel.
3. Determine the energy generated when PV modules are placed at different positions to sun rays
4. Calculate the efficiency of a stand alone PV System
5. Measurement by using 4 quadrant power supply and solar cell as load and under illumination
6. Calculate the life time for a solar cell Simulate using simulator

List of Experiments

1. Identifying and measuring the parameters of a solar PV Module in the field
2. Series and Parallel connection of PV Modules
3. Dark and Illuminated Current-Voltage characteristics of solar cell
4. Estimating the effect of Sun tracking on energy generation by solar PV modules
5. Efficiency measurement of standalone solar PV system
6. Dark and Illuminated Current-Voltage characteristics of solar cell

Unit: 1 Introduction to Energy and Solar Photovoltaic Energy


Unit: 2 Solar PV Modules

Ratings of PV Module, Module Parameters, Factors Affecting Electricity Generated by Solar PV Module, Measuring Module Parameters, Connection of Modules in Series, Connection of Modules in Parallel

Unit: 3 Charge Controller, MPPT and Inverters:

Power Converters and their Efficiency, AC to DC Converter, DC to AC Converter, DC to DC Converters, Charge Controllers, MPPT

Text Book:


References:


SEMMESTER VI

EEB304 POWER SYSTEM ANALYSIS

PREREQUISITE
EE B 302 - Transmission & Distribution
EE B 202 - Electrical Machines - I
EE B 205 - Electrical Machines - II

GOAL
To make the students to understand the different methods of power system analysis for power system planning and operation.

OBJECTIVES
The course will enable the students to:
(i) Analyze the different aspects of modeling of components of a modern power system.
(ii) Provide adequate knowledge in different power flow studies.
(iii) Give basic knowledge in different types of faults and methods to carry out the fault analysis.
(iv) Provide the concept of stability problems and the methods of determining the system stability.

OUTCOME
The students should be able to:
(i) Develop the mathematical model for carrying out the various types of power system analysis.
(ii) Understand the concept of the load flow problem formulation and the various numerical methods of solution.
(iii) Design a protective device for various faults.
(iv) Analyze unsymmetrical faults by applying symmetrical component methods.
(v) Understand the concept of system stability by applying equal area criterion and by using swing curve.

UNIT I THE POWER SYSTEM - AN OVERVIEW AND MODELLING
Modern Power System - Basic Components of a power system - Per Phase Analysis Generator model - Transformer model - line model. The per unit system - Change of base - per unit impedance diagrams.

UNIT II POWER FLOW ANALYSIS

UNIT III BALANCED FAULT ANALYSIS
Introduction - Types of faults - Balanced three phase fault - short circuit capacity - algorithm for formation of bus impedance matrix - systematic fault analysis using bus impedance matrix.

UNIT IV UNBALANCED FAULT ANALYSIS
Introduction - Fundamentals of symmetrical components - sequence impedances - sequence
networks - single line to ground fault - line to line fault - Double line to ground fault - Unbalanced fault analysis using bus impedance matrix.

UNIT V  POWER SYSTEM STABILITY


L=45, T=15, TOTAL = 60

TEXT BOOKS:

REFERENCES

EEB305 MICROPROCESSOR AND MICROCONTROLLER

PREREQUISITE
EE B 207 - Digital Logic Circuits

GOAL
To excel in the Architecture of 8085,8086 & 8051 and to develop skill in simple program writing, to study simple applications.

OBJECTIVES
The course should enable the students to:
(i) Study the Architecture of 8085, 8086 & 8051.
(ii) Know the addressing modes & instruction set of 8086 & 8051.
(iii) Know the need & use of Interrupt structure.
(iv) Program simple coding.
(v) Understand commonly used peripheral / interfacing ICs.

OUTCOME
The students should be able to:
(i) Understand the functional block diagram, Timing Diagram, Interrupt structure and Multiprocessor configurations of 8086 Microprocessor.
(ii) Develop the Programming skills using Loop structure with counting & Indexing, Look up table, Subroutine instructions stack.
(iii) Interface ICs 8255 PPI, 8259 PIC, 8257 DMA , 8251 USART, 8279 Key board display
controller and 8253 Timer/ Counter , A/D and D/A converter.

(iv) Comprehend the Functional block diagram, Instruction format and addressing modes, Interrupt structure , I/O Ports and Serial communication of 8051 Microcontroller.

(v) Develop the programming skills in PID control algorithm, square, triangular and sine wave form generation, closed loop control of servo motor and stepper motor control.

UNIT I 8085 and 8086 PROCESSOR


UNIT II PROGRAMMING OF 8086 PROCESSOR

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

UNIT III PERIPHERAL INTERFACING

Study of Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8257 DMA 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter - Interfacing with 8085 - A/D and D/A converter interfacing.

UNIT IV MICROCONTROLLER 8051

Functional block diagram - Instruction format and addressing modes - Interrupt structure - Timer - I/O ports - Serial communication.

UNIT V MICROCONTROLLER PROGRAMMING & APPLICATIONS

Data Transfer, Manipulation, Control & I/O instructions - Simple programming exercises, PID control algorithm - wave form generation: square, triangular and sine, key board and display interface - Closed loop control of servo motor- stepper motor control.

L : 45 TOTAL : 45

TEXT BOOKS


REFERENCES

PREREQUISITE
EE B 202 - Electrical Machines - I
EE B 205 - Electrical Machines - II

GOAL
To provide knowledge about fundamental design processes for electrical machines such as d.c. machines, transformers, induction machines & synchronous machines

OBJECTIVES
The course should enable the students to:

(i) Get exposed to the concepts of electromagnetic fields as applied to electrical machines
(ii) Acquire basic knowledge about critical design parameters
(iii) Design various electrical machines from the performance parameters.

OUTCOME
The students should be able to:

(i) Design common DC and AC rotating machines.
(ii) Design the core, windings and cooling system for transformers
(iii) Grasp industrial design processes with a minimum learning curve.

UNIT I MAGNETIC CIRCUITS AND COOLING OF ELECTRICAL MACHINES
Concept of magnetic circuit - MMF calculation for various types of electrical machines - real and apparent flux density of rotating machines - leakage reactance calculation for transformers, induction and synchronous machine - thermal rating: continuous, short time and intermittent short time rating of electrical machines - direct and indirect cooling methods - cooling of turbo alternators.

UNIT II D.C. MACHINES
Constructional details - output equation - main dimensions - choice of specific loadings - choice of number of poles - armature design - design of field poles and field coil - design of commutator and brushes - losses and efficiency calculations.

UNIT III TRANSFORMERS
Constructional details of core and shell type transformers - output rating of single phase and three phase transformers - optimum design of transformers - design of core, yoke and windings for core and shell type transformers - equivalent circuit parameter from designed data - losses and efficiency calculations - design of tank and cooling tubes of transformers.

UNIT IV THREE PHASE INDUCTION MOTORS
Constructional details of squirrel cage and slip ring motors - output equation - main dimensions - choice of specific loadings - design of stator - design of squirrel cage and slip ring rotor - equivalent circuit parameters from designed data - losses and efficiency calculations.

UNIT V SYNCHRONOUS MACHINES
Constructional details of cylindrical pole and salient pole alternators - output equation - choice of specific loadings - main dimensions - short circuit ratio - design of stator and rotor of cylindrical pole and salient pole machines - design of field coil - performance calculation from
designed data - introduction to computer aided design.

TEXT BOOKS

REFERENCES

EEC356 HIGH VOLTAGE ENGINEERING

PREREQUISITE
EE B 301 - Power Electronics

COREQUISITE
EE C 359 - Solid State Drives

GOAL
To provide knowledge about the testing of apparatus and measurements of overvoltages.

OBJECTIVES
The course will enable the students to:
(i) Give exposure on various types of over voltage transient in power system and its effect
(ii) Study about generation of overvoltages.
(iii) Provide knowledge on the measurement of electrical breakdown in various medium
(iv) Give basic knowledge in testing of power apparatus.

OUTCOME
The students should be able to:
(i) Understand the types of overvoltage transients on power system
(ii) Gain knowledge about the testing of power apparatus and generation of over voltages
(iii) Comprehend about the measurement of electrical breakdown in various medium
(iv) Understand the concept of insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS

Causes of over voltages and its effects on power system - Lightning, switching surges and temporary over voltages - protection against over voltages - Bewley's lattice diagram.
UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS
Gaseous breakdown in uniform and non-uniform fields - Corona discharges - Vacuum breakdown - Conduction and breakdown in pure and commercial liquids - Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS
Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS
Measurement of High voltages and High currents - Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION
High voltage testing of electrical power apparatus - Power frequency, impulse voltage and DC testing - International and Indian standards - Insulation Coordination.

TEXT BOOKS

REFERENCES

EEC357 RENEWABLE ENERGY SYSTEMS

PREREQUISITE
EE B 302 - Transmission & Distribution
EE B 304 - Power System Analysis

GOAL
To provide the knowledge about renewable energy systems

OBJECTIVES
The course will enable the students:
(i) To learn the types of renewable energy sources
(ii) To study the application of electrical machines in renewable energy conversion
(iii) To study the application of semiconductor devices in renewable energy conversion
(iv) To analyze the grid integrated renewable energy.
(v) To introduce the hybrid renewable energy systems
OUTCOME
The students should be able to:

(i) Understand the behavior of different renewable energy sources.
(ii) Study the Roll of electrical machines in renewable energy conversion.
(iii) Design the converters for renewable energy conversion.
(iv) Estimate the various parameters in the grid integrated system.
(v) Understand the application of hybrid renewable energy systems.

UNIT I  INTRODUCTION
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II  ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION
Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III  POWER CONVERTERS

UNIT IV  ANALYSIS OF WIND AND PV SYSTEMS
Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system

UNIT V  HYBRID RENEWABLE ENERGY SYSTEMS
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV- Maximum Power Point Tracking (MPPT).

TOTAL : 45

TEXT BOOKS

REFERENCES
EEC358 MICRO-CONTROLLER AND DSP BASED SYSTEM DESIGN

Prerequisite:
EE B 305 – Microprocessor & Microcontroller

Goal:
To provide knowledge of control of electrical drives employing embedded controllers

Objectives:
The course will enable the students to:

(i) Know the basic of PIC16C7X microcontroller
(ii) Know the basic of various peripherals connected to PIC16C7X.
(iii) Know the basics of Digital Signal Processors
(iv) Know the basic of various peripherals connected to Signal Processors.
(v) Give basic of designing a microcontroller based system

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

(i) Understand the architecture, instruction set, various peripherals of PIC16C7X
(ii) Program in PIC16C7X for simple arithmetic operation.
(iii) To understand the basic architecture of digital signal processors and writing simple application programs for signal processors.
(iv) To understand Peripherals of Signal processors and developing application using peripherals.

Design a microcontroller based system

1. PIC 16C7X MICROCONTROLLER
   Architecture memory organization – Addressing modes – Instruction set – Programming techniques – simple programs

2. PERIPHERALS OF PIC 16C7X
   Timers – interrupts – I/O ports – I2C bus for peripheral chip access – A/D converter – UART

3. MOTOR CONTROL SIGNAL PROCESSORS
   Introduction- System configuration registers - Memory Addressing modes - Instruction set – Programming techniques – simple programs

4. PERIPHERALS OF SIGNAL PROCESSORS
   General purpose Input/output (GPIO) Functionality- Interrupts - A/D converter-Event Managers (EVA, EVB)- PWM signal generation

5. APPLICATIONS OF PIC AND SIGNAL PROCESSORS
   Voltage regulation of DC-DC converters- Stepper motor and DC motor control- Clarke’s and parks transformation-Space vector PWM- Control of Induction Motors and PMSM.

TOTAL: 45 PERIODS
TEXT BOOKS:

2. Hamid A. Toliyat, Steven Campbell, 'DSP based electromechanical motion control,' 23 CRC Press

EEC359 SOLID STATE DRIVES

PREREQUISITE

EE B 301 – Power Electronics

GOAL

To provide knowledge about the operation of electric drives controlled from a power electronic converter and to introduce the design concept of controllers.

OBJECTIVES

The course will enable the students to:

(vi) Provide the concept of drive characteristics, four quadrant operation and different modes of operation of electric drives and regenerative braking.
(vii) Give basic knowledge in analysis of single and three phase fully controlled converter fed DC motor drive and chopper fed DC drive
(viii) Provide the concept of induction motor control and induction motor drives.
(ix) Give adequate knowledge about various types of control in synchronous motor and types of permanent magnet synchronous motor.

OUTCOME

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

(v) Select the suitable drive for the required load characteristics.
(vi) Understand the concept of Converter / Chopper control of Dc motor drive.
(vii) Gain adequate knowledge about induction motor and synchronous motor drive and various speed control methods.
(viii) Design controllers for drives.

UNIT I DRIVE CHARACTERISTICS

Equations governing motor load dynamics - Equilibrium operating point and its steady state stability - Mathematical condition for steady state stability and problems - Multi quadrant dynamics in the speed torque plane - Basics of regenerative braking - Typical load torque characteristics - Acceleration, deceleration, starting and stopping.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive: Continuous and discontinuous conduction mode - Chopper fed D.C drive: Time ratio control and current limit control - Operation of four quadrant chopper.

UNIT III INDUCTION MOTOR DRIVES

Stator voltage control - Slip-power recovery drives - Adjustable frequency drives: v/f control, constant slip-speed control and constant air-gap flux control – Basics of voltage/current fed inverters - Block diagram of closed loop drive.
UNIT IV SYNCHRONOUS MOTOR DRIVES
Open loop volts/hertz control and self-control of synchronous motor: Marginal angle control and power factor control - Permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES
Transfer function for dc motor, load and converter – Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control - Design of controllers: Current controller and speed controller - Converter selection and characteristics.

TEXT BOOKS

REFERENCES

EEC360REAL TIME SYSTEMS

GOAL
To develop in-depth skills in Real Time Operating Systems.

OBJECTIVES
The course will enable the students to:
(i) Review Operating Systems.
(ii) Understand about Distributed Operating Systems.
(iii) Learn Real Time Models and Languages.
(iv) Understand about introduction toRealTimeKernels.
(v) Understand about RTOS andApplicationDomains.
OUTCOME
The students should be able to:

(i) Explain various operating systems
(ii) Explain Basic building blocks of Real time Systems.
(iii) Interface various peripherals to RTOS.
(iv) Program Real time Systems.
(v) Develop Real time Systems.

UNIT I REVIEW OF OPERATING SYSTEMS
Basic Principles – system calls-Files-Processes-Design and implementation of processes – Communication between processes operating system structures.

UNIT II DISTRIBUTED OPERATING SYSTEMS
Topology-Network Types-Communication-RPC-Client server model- Distributed file systems.

UNIT III REAL TIME MODELS AND LANGUAGES
Event based – Process based – Graph models – Petrinet models - RTOS tasks – RT scheduling- Interrupt processing-Synchronization-Control blocks-Memory requirements.

UNIT IV REAL TIME KERNEL
Principles – Polled loop systems - RTO Sporting to a target - Comparison and Study of RTOS- VX Works and µCoS, Introduction to POSIX and OSEK standards.

UNIT V RTOS AND APPLICATION DOMAINS
RTOS for Control-Embedded RTOS for Control over IP - RTOS for fault tolerant applications - RTOS for control systems.

L : 45 TOTAL : 45

TEXTBOOKS

REFERENCES
1. Rajbuhr, DLBeily, 'An introduction torealtimesystems 'PHI, 1999
Goal:
To gain knowledge in state variable analysis, non-linear systems and optimal

Objectives:
The course will enable the students to:
(i) study the basics state variable analysis
(ii) provide adequate knowledge in the phase plane analysis.
(iii) To give a basic knowledge in describing function analysis.
(iv) analyze the stability of the systems using different techniques.
(v) Study the design of optimal controller.

Outcome:
At the end of this course students should have knowledge in the following:
(i) State variable analysis and its application
(ii) Phase plane analysis and application
(iii) Describing function and its analysis for common non-linearities
(iv) Various stability analysis techniques
(v) Various optimal control methods

UNIT I STATE VARIABLE ANALYSIS 9
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 - Pole
Placement – State observer Design of Control Systems with observers.

UNIT II PHASE PLANE ANALYSIS 9
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 III DESCRIBING FUNCTION ANALYSIS 9
Basic concepts, derivation of describing functions for common non-linearities – Describing

UNIT IV STABILITY ANALYSIS 9
Introduction – Liapunov’s stability concept – Liapunov’s direct method – Lure’s transformation
– Aizerman’s and Kalman’s conjecture – Popov’s criterion – Circle criterion.
UNIT V OPTIMAL CONTROL


L = 45 TOTAL = 45 PERIODS

TEXT BOOKS

REFERENCES

EEC362 NUCLEAR SCIENCE AND ENGINEERING L T P C
(Common to Mechanical) 3 0 0 3

OBJECTIVE
To provide an insight into the basic concepts of Nuclear Science and principles of Nuclear Reactors including fast breeder reactors.

OUTCOME:-
1. To understand the nuclear energy generation
2. To understand the nuclear plant structures

UNIT I INTRODUCTION

Nuclear energy fundamentals- atomic structureand isotopes-Nuclear Binding energy – Neutron reactions _ Radio activity.

UNIT II THE FISSION PROCESS


UNIT III NUCLEAR REACTORS

Reactor kinetics – Types of reactors – Thermal reactors - Pressurized water reactors - Boiling water reactor - Pressurized heavy water reactor - Fast reactors - Sodium cooled
reactors-Gas cooled reactors - Pb Bi cooled reactors - General features of reactor control – Nuclear fuel utilization – Fast breeder reactors.

UNIT IV NUCLEAR POWER PLANTS


UNIT V ENVIRONMENTAL EFFECTS AND WASTE MANAGEMENT


REFERENCES


15. “Power Plant Engineering & Economics” - Strosal & Vapet

16. “IAEA Directory of Nuclear Reactors” Vol. IV, Power Reactors, Vienna

**EEC363  POWER PLANT ENGINEERING**

**3 CREDITS**

**PREREQUISITE**
EE B 202 - Electrical Machines - I

**GOAL**
To provide knowledge about various power plant and its operation

**OBJECTIVES**
The course will enable the students to:
(i) Learn the basics of thermal energy conversion to electrical energy
(ii) Learn the layout and components of hydro electric power plant
(iii) Learn the principle of fission reaction and nuclear power generation
(iv) Learn the basics of gas and diesel power plant
(v) Learn the basics of non conventional power generation

**OUTCOME**
The students should be able to:
(i) Understand Thermal power plant operation.
(ii) Understand Hydro electric power plant operation
(iii) Understand Principle of nuclear power generation
(iv) Understand Basics of gas and diesel power generation, inter-cooling and various layout
(v) Understand Principle and layout of various non conventional power generation

**UNIT I  THERMAL POWER PLANTS**
Basic thermodynamic cycles, various components of steam power plant-layout-pulverized coal burners-Fluidized bed combustion-coal handling systems-ash handling systems- Forced draft and induced draft fans- Boilers-feed pumps-super heater-regenerator-condenser-dearearators-cooling tower

**UNIT II  HYDRO ELECTRIC POWER PLANTS**
Layout-dams-selection of water turbines-types-pumped storage hydel plants

**UNIT III  NUCLEAR POWER PLANTS**
Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear power plants
UNIT IV  GAS AND DIESEL POWER PLANTS
Types, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance-reheating, intercoolings, regeneration-advantage and disadvantages- Diesel engine power plant-component and layout

UNIT V  NON-CONVENTIONAL POWER GENERATION
Solar energy collectors, OTEC, wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation-principle, thermoelectric power generation, thermionic power generation.

TEXT BOOKS

REFERENCES

EED352  ENERGY AUDIT AND ENERGY REGULATION

Goal:
To give basic concepts of Energy Audit, Different Energy management techniques and Energy policies.

Objectives:
The course will enable the students to:

(i) Adopt Conservation methods in various systems.
(ii) Learn various technically proven ways to conserve Energy and then prioritize them based on the cost benefit analysis.
(iii) Select appropriate tariff system and methods for reducing electricity consumption and promote energy saving.

Apply Tools for energy audit and recommend measures for energy

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

(i) work as supervisor /Energy Auditor/Cost Analyzer in industry/Power utility/Public sector
(ii) Assess energy conservation potential in various systems
UNIT I INTRODUCTION

Energy Management (Audit):


UNIT II ELECTRICAL ENERGY SYSTEMS


UNIT III EFFICIENCY IN MOTOR AND LIGHTING SYSTEM


Lighting- Basic terms used in Lighting System(Illumination),Energy conservation techniques in Lighting system: Replacing lamp sources, Energy efficient luminaries, Light control gears/circuits, Installation of exclusive transformer/servo stabilizer for lighting.

UNIT IV ENERGY POLICIES


UNIT V ENERGY AND ENVIRONMENT


L = 45 TOTAL : 45

Text / Reference Books

3. Annual Energy Planning Reports of CMIE, Govt. of India.

Energy Efficiency Websites:
www.altenergy.com
www.bee-india.nic.in
www.greenbusiness.com
www.worldenergy.org

EEB334 MICROPROCESSOR AND MICROCONTROLLER LABORATORY
L T P C
0 0 3 1

PREREQUISITE / CO REQUISITE
EE B 207 - Digital Logic Circuits
EE B 305 - Microprocessor and Microcontroller

GOAL
To understand programming using instruction sets of processors and controllers.

OBJECTIVES
The course should enable the students to:
(i) Develop skill in simple program writing for 8086 Microprocessors and Microcontrollers.
(ii) Introduce commonly used peripheral / interfacing ICs
(iii) Study simple applications like D / A converter and A/D Converter.
(iv) Understand about assembler and simulator tools

OUTCOME
The students should be able to:
(i) Develop skill in simple program writing for 8086 Microprocessors Simple arithmetic operations, Programming with control instructions.
(ii) Interface Analog to Digital Converter, Digital to Analog Converter, experiments using 8251, 8279, 8254
(iii) Program on assembler and simulator tools.
(iv) Perform Parallel port programming with 8051 with Stepper motor and D/A converter.

**LIST OF EXPERIMENTS 16-BIT MICROPROCESSOR**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8-bit arithmetic operations</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>16-bit arithmetic operations</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Double Precision Arithmetic operations</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>8-bit multiplication using rotate instruction &amp; Sorting of N numbers</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Greatest &amp; Smallest of N numbers in a given array</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Code Conversions</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Square &amp; Square root of a given number using Look-up Table method</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Interfacing ADC &amp; DAC with 8086</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Traffic Light Control &amp; Keyboard Display Interfacing using 8086</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Interfacing 8086 with 8254 &amp; 8251</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>Programming practice on assembler &amp; simulation tools</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>8-bit arithmetic operations using 8051 microcontroller</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>RAM direct addressing &amp; bit addressing</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>Stepper Motor Interfacing using 8051</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Programming practice using simulation tools &amp; C-compiler</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>Study of Microcontrollers with flash memory</td>
<td>1</td>
</tr>
</tbody>
</table>

**LIST OF EQUIPMENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8086 Microprocessor Trainer with Power supply</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>8051 Micro controller Trainer Kit with power supply</td>
<td>15</td>
</tr>
<tr>
<td>3.</td>
<td>8255 Interface board</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>8251 Interface board</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>8259 Interface board</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>8279 Keyboard/Display Interface Board</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>8254 timer counter</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>ADC card</td>
<td>5</td>
</tr>
<tr>
<td>9.</td>
<td>DAC card</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>Stepper motor with Controller</td>
<td>5</td>
</tr>
<tr>
<td>11.</td>
<td>Traffic Light Control System</td>
<td>5</td>
</tr>
<tr>
<td>12.</td>
<td>Regulated power supply</td>
<td>10</td>
</tr>
</tbody>
</table>
13. Universal ADD-ON modules 5
14. 8 Digit Multiplexed Display Card 5
15. Multimeter 5
16. C R O 2

EEB335 POWER SYSTEM SIMULATION LABORATORY

PREREQUISITE / CO REQUISITE
EE B 304 - Power System Analysis
EE B 302 - Transmission and Distribution

GOAL
To expose the various power system parameters through computational procedures using software languages and MATLAB/simulink.

OBJECTIVES
The course should enable the students to:
(i) Modeling of transmission line
(ii) Electromagnetic transients in travelling waves
(iii) Formation of bus admittance matrix
(iv) Different methods of power flow analysis
(v) Formation of bus impedance matrix using building algorithm.
(vi) Short circuit analysis of transmission line
(vii) Stability analysis of power system
(viii) Analysis of switching surge using ETAP

OUTCOME
The students should be able to:
(i) Determine the various line parameters of a transmission line
(ii) Identify the types of transients in travelling waves.
(iii) Form the bus admittance matrix for the given power system network by Step by step method or singular transformation method.
(iv) Carry out load flow analysis for the given power system network by using Gauss-seidel method and determine line losses.
(v) Determine the bus parameters and line flows using Newton-Raphson load flow analysis.
(vi) Analyze fault in the transmission line using bus impedance matrix.
(vii) Analyze fault in the transmission line using short circuit capacity.
(viii) Analyze the stability of the given power system network using swing curve.
(ix) Analyze of Energization and De-Energisation of transmission line
(x) Determine the bus parameters and line flows using Fast decoupled method
LIST OF EXPERIMENTS

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<tr>
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<th>No. of Hours</th>
</tr>
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</tr>
<tr>
<td>2</td>
<td>Electromagnetic transients in travelling waves</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Formation of bus admittance matrix</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Power flow analysis by Gauss-seidel method</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Power flow analysis using Newton-Raphson method</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Formation of bus impedance matrix using building algorithm</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Short circuit analysis of transmission line</td>
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<td>Stability analysis of power system</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Analysis of switching surge using ETAP</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Power flow analysis by Fast decoupled method</td>
<td>4</td>
</tr>
</tbody>
</table>

P : 45 Total : 45

LIST OF EQUIPMENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Computer</td>
<td>Pentium 4</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>ETAP software</td>
<td>ETAP Ver 12.1</td>
<td>10 licence user</td>
</tr>
<tr>
<td>3</td>
<td>MATLAB</td>
<td>MATLAB Ver 7.1</td>
<td>10 licence user</td>
</tr>
<tr>
<td>4</td>
<td>Turbo C</td>
<td>C &amp; C++</td>
<td>30 user</td>
</tr>
</tbody>
</table>

ELA331 COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

GOAL

The goal of the programme is to provide the learners with the methods and materials required for becoming accomplished personalities through the medium of English.

OBJECTIVES

The course should enable the students to:

1. Be aware of self-knowledge by exposure to soft skills, values, behaviour, attitudes, temperamental changes, and a positive attitude to life.

2. Learn personality traits and undergo personality tests to determine their own personality characteristics and the scope for improvement.

3. Cultivate the art of speaking fluently making use of proper gestures, tone and voice modulation, adding humour to the speech.

4. Figure out the need to work in teams, adorn or accept team leadership, and make use of body language to enhance team spirit.

5. Be familiar with the art of managing self, people, work and time, keeping in mind problems like time-wasters and stress-builders.
OUTCOME

The students should be able to:

1. **Apply the knowledge gained to improve upon their values, behaviour, attitude, and develop the soft skills required for home, workplace and the society.**

2. **Employ the concept of personality traits and build up an accomplished personality that would be pleasing to people around so as to influence them positively.**

3. **Develop a personal style and communicate fearlessly and effectively in a convincing manner so as to impress listeners or the audience.**

4. **Participate in presentations, group discussions, debates and mock interviews making good use of language skills and interpersonal relationships.**

5. **Comprehend stress-management tips to overcome stress-prone habits and develop a career plan with personal, familial and societal goals for success.**

UNIT I

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social values -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

UNIT II

What is personality development? - Types of personalities as per (i) Heredity (ii) Environment (iii) Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.

UNIT III


UNIT IV

Team work - Team building - Team leadership -- How to face an interview? -- How to participate in a group discussion? - How to argue for or against in a debate? - Body language - non-verbal communication - personal appearance - facial expression - posture - gestures - eye contact - Etiquette - Voluntary and involuntary body language -Gender implications -- Tests.

UNIT V


**Study material will be prepared by the Department of Languages. Tests suggested will be prepared by a senior faculty of the department.**
Movies will be screened to discuss and debate on the topics introduced in each unit. LABORATORY REQUIREMENTS

1. Career Lab: 1 room
2. 2 Computers as a Server for Labs (with High Configuration)
3. Headphones with Mic (i-ball) - 100 Nos
4. Speakers with Amplifiers, Wireless Mic and Collar Mic - 2 Sets
5. Teacher table, Teacher Chair - 1 + 1
6. Plastic Chairs - 75 Nos
SEMESTER-VII

EEB401 POWER SYSTEM OPERATION AND CONTROL

PREREQUISITE
EE B 302 - Transmission & Distribution
EE B 304 - Power System Analysis
EE B 206 - Control Systems

GOAL
To become familiar with the preparatory work necessary for understanding the operation and the various control actions to be implemented on the power system to meet the minute-to-minute variation of system load.

OBJECTIVES
The course will enable the students to:

(i) Have an overview of system load variation, reserve requirements, operation and control of power system.
(ii) Give an insight into the role of speed governing mechanism in load frequency control, concept of control area, modeling and analysis of load frequency control loop.
(iii) Give knowledge of excitation systems and the methods of voltage control.
(iv) Study the economic dispatch of generated power.
(v) Provide adequate knowledge of the functions of energy control centre, SCADA system and the security control.

OUTCOME
The students should be able to:

(i) Understand the need for power system operation and control.
(ii) Get knowledge of the mechanism involved in maintaining the frequency constant by controlling the real power, when there is a system load variation.
(iii) Understand voltage constancy and the methods of voltage control.
(iv) Learn economic scheduling of load among the generators and the concept of economic dispatch.
(v) Understand the methods of computer control using energy control centre and SCADA.

UNIT I INTRODUCTION
System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER-FREQUENCY CONTROL
Fundamentals of speed governing mechanism and modeling: Speed-load characteristics. Load sharing between two synchronous machines in parallel; concept of control area, LFC...
control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases. Multi-area systems: Two-area system modeling; static analysis, uncontrolled case; tie line with frequency bias control of two-area system. Derivation of state variable model.

UNIT III REACTIVE POWER-VOLTAGE CONTROL

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; method of voltage control: Injection of reactive power. Tap-changing transformer, numerical problems - System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems only in priority-list method using full-load average production cost.

Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. (No derivation of loss coefficients) Base point and participation factors. Economic dispatch controller added to LFC control.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS

Energy control centre: Functions - Monitoring, data acquisition and control. System hardware configuration - SCADA and EMS functions, state estimation, security analysis and control. Various operating states: Normal, alert, emergency, in extremis and restorative. State transition diagram showing various state transitions and control strategies.

L : 45  T : 15  TOTAL : 60

TEXT BOOKS


REFERENCES


GOAL
To provide a knowledge in data structures and Object oriented programming.

OBJECTIVES
The course should enable the student:
(i) To learn the systematic way of solving problems.
(ii) To understand the different methods of organizing large amounts of data.
(iii) To efficiently implement the different data structures.
(iv) To efficiently implement solutions for specific problems
(v) To give an In depth Knowledge in object oriented Programming

OUTCOME
The students should be able to:
(i) Have gained knowledge in problem solving techniques.
(ii) Be capable of writing programs using list, stack and queue.
(iii) Have obtained confidence in storing data in tree and other related data structures.
(iv) Have grasped knowledge in various sorting techniques.
(v) Have learnt the concepts in Inheritance, Abstract classes and virtual functions

UNIT I  LISTS, STACKS AND QUEUES  9
Abstract Data Type (ADT) - The List ADT - The Stack ADT - The Queue ADT

UNIT II  TREES AND SORTING  9

UNIT III  GRAPHS  9

UNIT IV  OBJECT ORIENTED PROGRAMMING AND C++  9
Basic concepts of object oriented programming - Benefits of OOP - Applications of OOP - Basics of C++ - Data types-Operators-Statements-Functions-Classes and Objects - Constructors-Destructors - Overloading

UNIT V  INHERITANCE, ABSTRACT CLASSES, VIRTUAL FUNCTIONS  9
Defining derived classes - Single inheritance - Multilevel inheritance - Multiple inheritance - Hierarchical inheritance - Hybrid inheritance - Virtual base classes - Abstract classes-Virtual functions

TOTAL : 45
TEXT BOOKS

REFERENCES

EEC451 POWER QUALITY

Prerequisite
EE B 304 - Power System Analysis,
EE B 401 - Power System Operation & Control,
MA A 201 – Engineering Maths – III

Goal
To study the various issues affecting Power Quality, their production, monitoring and suppression. This includes studying the production of voltages sags, over voltages and harmonics and methods of control and to various methods of power quality monitoring.

Objectives:
The course will enable the students to:

(i) Understand the concept of power quality involved terms and definitions
(ii) To study and understand the concept of over voltages and the mitigation methods along with PSCAD and EMTP
(iii) Understand various types of sources and control techniques of voltage sags.
(iv) Understand various types of sources and control techniques of harmonics.
(v) Acquire knowledge power quality monitoring.

Outcome:
After completion of the course the students are expected to be able to:

(i) Gain knowledge about over voltages and the mitigation methods using PSCAD and EMTP
(ii) Gain knowledge about various types of sources and control techniques of harmonics.
(iii) Gain knowledge about power quality monitoring.
(iv) Gain knowledge about various types of sources and control techniques of harmonics.

UNIT I INTRODUCTION TO POWER QUALITY

Terms and definitions: Overloading, under voltage, sustained interruption; sags and swells; waveform distortion, Total Harmonic Distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS

Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES

Sources of over voltages: Capacitor switching, lightning, ferro resonance; mitigation of voltage swells: Surge arresters, low pass filters, power conditioners – Lightning protection, shielding, line arresters, protection of transformers and cables, computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS

Harmonic distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads, locating harmonic sources; power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING

Monitoring considerations: Power line disturbance analyzer, per quality measurement equipment, harmonic / spectrum analyzer, flicker meters, disturbance analyzer, applications of expert system for power quality monitoring.

REFERENCES


GOAL

To provide knowledge about the Industrial applications of optical fibers and laser instruments.

OBJECTIVES

The course will enable the students to:

(i) Get exposed to the basic concepts of optical fibers and their properties.
(ii) Acquire adequate knowledge about the Industrial applications of optical fibers.
(iii) Acquire knowledge about Laser fundamentals and Industrial application of lasers.
(iv) Get adequate knowledge about holography & Medical applications of Lasers.

OUTCOME
The students should be able to:
(i) Specify and operate optical test instrumentation, for example, optical spectrum analyzers and laser beam profilers.
(ii) Align, maintain and operate optical components and support and positioning equipment.
(iii) Survey a laser work area, citing unsafe conditions present.
(iv) Gain knowledge about Holographic techniques and medical applications of laser.

UNIT I  OPTICAL FIBERS AND THEIR PROPERTIES
Principles of light propagation through a fiber - Different types of fibers and their properties, fiber characteristics - Absorption losses - Scattering losses - Dispersion - Connectors & splicers - Fiber termination - Optical sources - Optical detectors.

UNIT II  INDUSTRIAL APPLICATION OF OPTICAL FIBERS
Fiber optic sensors - Fiber 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
Fundamental characteristics of lasers - Three level and four level lasers - Properties of laser - Laser modes - Resonator configuration - Q-switching and mode locking - Types of lasers - Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

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

UNIT V  HOLOGRAM AND MEDICAL APPLICATIONS

TEXT BOOKS

REFERENCES
Prerequisite

EE B202 – Electrical Machines - I
EE B 205 – Electrical Machines – II

Goal
To expose the students to the construction, principle of operation and performance of special electrical machines such as synchronous reluctance motor, switched reluctance motor, stepper motor, permanent magnet synchronous motor etc..

Objectives
The course will enable the students to:

(i) Provide the concept of construction, operating principle and characteristics of synchronous reluctance motor, stepper motor and switched reluctance motor..

Give basic knowledge about the principle of operation, analysis, emf and torque equation, and control of permanent magnet synchronous motors and brushless DC motors

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

(i) Gain knowledge about construction, operating principle and characteristics of synchronous reluctance motor, stepper motor and switched reluctance motor..

(ii) Comprehend about permanent magnet synchronous motors and brushless DC motor and its applications.

UNIT I STEPPING MOTORS

Constructional features, principle of operation, modes of excitation, torque production in Variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, Closed loop control of stepping motor

UNIT II SWITCHED RELUCTANCE MOTORS

Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control Microprocessor based controller.

UNIT III PERMANENT MAGNET BRUSHLESS DC MOTORS

Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equations, Torque-speed characteristics, Controllers-Microprocessor based controller.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self control, Vector control, Current control schemes.

UNIT V SYNCHRONOUS RELUCTANCE MOTORS

Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – phasor diagram, motor characteristics.

TEXT BOOKS

REFERENCES

EIC452 BIOMEDICAL INSTRUMENTATION

PREREQUISITE
EE B 204 - Measurement & Instrumentation

GOAL
To provide knowledge about the concept of different biomedical instruments & application

OBJECTIVES
The course will enable the students to:
(i) Acquire knowledge about physiology and transducer
(ii) Acquire knowledge about electro physiological measurements.
(iii) Acquire knowledge of non-electrical parameter measurement
(iv) Get knowledge of medical imaging and PMS
(v) Know about assisting & therapeutic equipment.

OUTCOME
The students should be able to:
(i) Gain knowledge about human nervous system, cardio pulmonary system..
(ii) Acquire knowledge about transducer & components of biomedical system

(iii) Gain knowledge about EEG, ECG, EMG etc.

(iv) Gain knowledge about parameter.

(v) Gain knowledge about diff. imaging techniques.

(vi) Gain knowledge about the equipment.

UNIT I PHYSIOLOGY AND TRANSDUCERS

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 - Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers - Selection criteria.

Basic components of a biomedical system - Electrodes - Micro, needle and surface electrodes - Amplifiers - Preamplifiers, differential amplifiers, chopper amplifiers - Isolation amplifier.

UNIT II ELECTRO-PHYSIOLOGICAL MEASUREMENTS

ECG - EEG - EMG - ERG - Lead systems and recording methods - Typical waveforms.

UNIT III NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood pressure - Cardiac output - Cardiac rate - Heart sound - Respiratory rate - Gas volume - Flow rate of O2, Co2 in exhaust air - pH of blood, ESR, GSR measurements - Plethysmography.

UNIT IV MEDICAL IMAGING AND PMS


UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS


L : 45 TOTAL : 45

TEXT BOOKS


REFERENCES


PREREQUISITE
EE B 207 - Digital Logic Circuits
EE B 305 - Microprocessor & Microcontroller

GOAL
To provide the functional building blocks of an embedded for developing a real time system application.

OBJECTIVES
The course will enable the students to:

(i) Know the features that build an embedded system.
(ii) Get adequate knowledge about the interaction of various components within an embedded system
(iii) Get adequate knowledge about interfacing process
(iv) Get adequate knowledge of writing efficient programs on processor
(v) Acquire knowledge about RTOS.

OUTCOME
The students should be able to:

(i) Solve and design the real time embedded products
(ii) Solve the embedded products by using various parameters
(iii) Gain knowledge about various port devices
(iv) Solve competitive embedded programs using C
(v) Gain knowledge about the software in embedded system

UNIT I  INTRODUCTION TO EMBEDDED SYSTEM  9
Introduction to functional building blocks of embedded systems - Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories.

UNIT II  PROCESSOR AND MEMORY ORGANIZATION  6
Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management - Cache mapping techniques, dynamic allocation - Fragmentation.

UNIT III  DEVICES & BUSES FOR DEVICES NETWORK  9

UNIT IV  I/O PROGRAMMING SCHEDULE MECHANISM  12
Intel I/O instruction - Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overrun; disability interrupts.
Multi threaded programming - Context switching, premature & non-premature multitasking,
semaphores.

Scheduling - Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

UNIT V REAL TIME OPERATING SYSTEM (RTOS) 9

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS - Interrupt handling, task scheduling; embedded system design issues in system development process - Action plan, use of target system, emulator, use of software tools.

L : 45 TOTAL : 45

TEXT BOOKS


Prerequisites
EE B 304 - Power System Analysis
EE B 302 - Transmission and Distribution
EE C455 - Electrical Energy Generation Utilization and Conservation
EE B 401 - Power System Operation and Control

Goal
The first objective is to provide the students a systems perspective of modern electricity markets and a systems approach to address various issues faced by the electricity sector. The second objective is to present the student a vision of how Smart Grid will transform the current electricity grid to a reliable and sustainable modern energy system.

Objectives
The course will enable the students to:

(i) Understand the structure of an electricity market in either regulated or deregulated market conditions.
(ii) Understand the impacts of renewable resources to the grid and the various issues associated with integrating such resources to the grid.
(iii) Evaluate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets.
Understand the concepts and principles of Smart Grid, technology enabling, and demand participation.

Outcome
After completion of the course the students are expected to be able to:

(i) Gain knowledge about the economic fundamentals of power systems and electricity markets.
(ii) Understand the concepts of various components of Smart Grid, and their impacts on the energy industry, including renewable integration, demand side management, and greenhouse gas (GHG) emissions reductions.
(iii) Gain knowledge about the characteristics of smart grids
(iv) Gain knowledge about the basic elements and desirable traits of power grid

Gain adequate knowledge about desirable features of smart grid

UNIT I SUPPLY SIDE AND DEMAND SIDE OF ELECTRICITY 10

Basics of electricity- Fossil fuel and hydro power plants- Renewable and alternative energy-Supply curve- Load characteristics- Load curve and load duration curve- Demand side management- Plug-in hybrid vehicles and smart appliances

UNIT II TRANSMISSION AND DISTRIBUTION NETWORKS 8

Physical laws of electricity; AC vs. DC Powerflow- Optimal power flow and unit commitment models- Distribution network basics

UNIT III BASIC ELEMENTS AND DESIRABLE TRAITS OF SMART GRID 9

UNIT IV  KEY CHARACTERISTICS OF SMART GRID

Demand-side participation- Impacts of Smart Grid on reliability- Impacts of Smart Grid on air pollutant emissions reduction.

UNIT V  ISSUES RELATED TO SMART GRID

Communication and sensing in a smart grid- smart grid threats-vulnerabilities-cyber security strategies.

TEXT BOOKS :

2. John Wiley & Sons Ltd. 2009

REFERENCE:


EEC455 ELECTRICAL ENERGY GENERATION
UTILIZATION & CONSERVATION

PREREQUISITE

EE B 202 - Electrical Machines I
EE B 205 - Electrical Machines - II
EE C 353 - Solid State Drives

GOAL

To provide knowledge about the Industrial applications of generation, utilization & conservation.

OBJECTIVES

The course will enable the students to:

(i) Give exposure to the various sources of electric power generation.
(ii) Study the different methods of conservation of electric power.
(iii) Impart knowledge on the Lighting, Heating and welding methods.
(iv) Give adequate knowledge about electric traction system and their controls.
(v) Give exposure on the Industrial drives and load characteristics

OUTCOME

The students should be able to:

(i) Gain knowledge in different methods of electric power generation equipment.
(i) Comprehend about Energy conservation and energy management system.

(ii) Understand the concept of Industrial Heating, Welding and able to design lighting system for different applications.

(iii) Get knowledge on the latest trends of Electric drive system

UNIT I CONSERVATION

- Economics of Generation - Definitions - Load curves, Number & size of units - Cost of electrical energy - Tariff - Need for conservation - Conservation methods - Energy efficient equipment

- Energy Management and Auditing - Economics of power factor improvement - Design for improvement of power factor using power capacitors - Power Quality - Effect on conservation

UNIT II ILLUMINATION, HEATING AND WELDING

- Nature of radiation, Definition - Laws, Photometry - Lighting calculations - Design of illumination systems - Types of lamps - Energy efficient lamps

UNIT III HEATING AND WELDING

- Methods of heating, Requirement of heating material - Design of heating element, Furnaces - Welding generator, Welding transformer and its characteristics

UNIT IV ELECTRIC TRACTION

- Requirement of Ideal traction system - Supply Systems - Mechanics of train movement - Traction motors and control - Multiple units, Braking - Current collection systems - Recent trends in electric traction

UNIT V DRIVES & THEIR INDUSTRIAL APPLICATIONS

- Motor selection and related factors - Loads - Types - Characteristics - Steady and Transient Load Equalization - Industrial application - Modern methods of speed control of industrial drives

L : 45  TOTAL : 45

TEXT BOOKS


REFERENCES


PREREQUISITES

GOAL

To impart the students with the various aspects of pumps and machinery involved in Civil Engineering practice and the principles of electrical and air conditioning facilities involved.

OBJECTIVES

The course should enable the students to:

- Study about machineries used in the Civil Engineering field.
- Acquire knowledge about electrical systems in the buildings.
- Impart knowledge on the principles of Lighting and Illumination in the buildings.
- Familiarize with refrigeration principles and its applications.
- Create an awareness of the fire safety aspects in the buildings.

OUTCOME

The students should be able to:

- Describe the different machineries used in the construction.
- Plan the electrical wiring for the buildings.
- Design the lighting system required for different types buildings.
- Choose suitable refrigeration and air conditioning systems for different types of buildings.
- Describe the fire safety aspects of building services.

UNIT I  MACHINERIES  8

Hot Water Boilers - Lifts and Escalators - Special features required for physically handicapped and elderly - Conveyors - Vibrators - Concrete mixers - DC/AC motors - Generators - Laboratory services - Gas, water, air and electricity

UNIT II  ELECTRICAL SYSTEMS IN BUILDINGS  10

Basics of electricity - Single / Three phase supply - Protective devices in electrical installations - Earthing for safety - Types of earthing - ISI specifications - Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN  8


Design of modern lighting - Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.
UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

Thermodynamics - Heat - Temperature, measurement transfer - Change of state - Sensible heat - Latent heat of fusion, evaporation, sublimation - saturation temperature - Super heated vapour - Subcooled liquid - Pressure temperature relationship for liquids - Refrigerants - Vapour compression cycle - Compressors - Evaporators - Refrigerant control devices - Electric motors - Starters - Air handling units - Cooling towers - Window type and packaged air-conditioners - Chilled water plant - Fan coil systems - Water piping - Cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types - Heat and smoke detectors - Fire alarm system, snorkel ladder - Fire lighting pump and water storage - Dry and wet risers - Automatic sprinklers.

TOTAL = 45

TEXT BOOKS:


REFERENCES:


National Building Code.
GOAL
To teach the principles of good programming practice and to give a practical training in writing efficient programs in C++

OBJECTIVES
The course should enable the student to:
(i) Write programs in C++
(ii) Implement the various data structures as Abstract Data Types
(iii) Write programs to solve problems using the ADTs
(iv) Introduce constants, variables, data types, operators, classes, objects, methods
(v) Introduce inheritance, Abstract classes, Virtual functions

OUTCOME
The students should be able to:
(i) Have gained knowledge in problem solving techniques.
(ii) Be capable of writing programs using list, stack and queue.
(iii) Have obtained confidence in storing data in tree and other related data structures.
(iv) Have grasped knowledge in various sorting techniques.
(v) Have learnt the concepts in Inheritance, Abstract classes and virtual functions.

LIST OF EXPERIMENTS
Implement the following exercises using C++

<table>
<thead>
<tr>
<th>S.No</th>
<th>List of Experiments</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Array implementation of List Abstract Data Type (ADT)</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Array implementations of Stack ADT</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Linked list implementations of Stack ADT</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Array implementation of Queue ADT</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Linked list implementation of Queue ADT</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Balanced Paranthesis' using array implementation of Stack ADT</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Balanced Paranthesis' using linked list implementation of Stack ADT</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Evaluating Postfix Expressions' using array implementations of Stack ADT</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Quick Sort</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Compile time Polymorphism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Operator Overloading including Unary and Binary Operators.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Function Overloading</td>
<td>4</td>
</tr>
</tbody>
</table>
11. Runtime Polymorphism
   a. Inheritance
   b. Virtual functions
   c. Virtual Base Classes

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30

STUDENTS HARDWARE
LAN system with 30 nodes (OR) Standalone PCs - 30 Nos
Printers - 3 Nos

SOFTWARE
OS - Windows / UNIX
Software - C++ language

EEB431  ELECTRICAL DRIVES AND CONTROL LABORATORY

Prerequisite
EE B 301 – Power Electronics

Goal
To expose the students to the various control techniques of electrical machines and help them to extract their practical knowledge.

Objectives
The course will enable the students to do experiments on
(i) Speed control of Induction Motor using V/f method and 3 ø Voltage Source Inverter.
(ii) Speed control and braking of DC shunt motor using 3 ø converter.
(iii) Voltage & current control of DC motor using PLC.
(iv) Conventional and vector control of PMSM motor by using DSP.
(v) Two and four quadrant operation of a DC motor.
(vi) Open loop & Closed loop speed control of PMBLDC using PIC controller
(vii) Forward and Reverse operation of stepper motor by micro controller.
(viii) Speed control of universal motor using controlled rectifier.

Outcome
At the end of the course, the student should be able to:
(i) Understand the various methods of speed control of induction motor.
(ii) Understand the methods of speed control and braking methods of dc motor using power electronics devices.
(iii) Analyze the current and voltage control of dc motor using the new technology PLCs, will help them to get industrial job opportunities.

(iv) PMSM motor control using vector control will enable them to go for higher studies.

(v) Analyze the dc motor operation in four quadrant using power electronics devices.

(vi) Get knowledge in control techniques of special electrical machines like BLDC, PMSM and Stepper motor.

(vii) Get knowledge in universal motor control techniques for different applications.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Experiment</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed control of Induction Motor using V/f method and 3 Ø Voltage Source Inverter</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Open loop &amp; Closed loop speed control of BLDC using PIC controller</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Speed control of universal motor using controller rectifier.</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Two and four quadrant operation of a DC motor.</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Conventional control of PMSM motor by using DSP/PIC</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Vector control of PMSM motor by using DSP/PIC</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Forward and Reverse operation of stepper motor by micro controller.</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Braking methods of a DC motor.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>a) Dynamic Braking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Regenerative Braking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Plugging</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Speed control of DC shunt motor using 3 Ø converter.</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Voltage &amp; current control of DC motor using PLC.</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Model Exam</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>45</strong></td>
</tr>
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</table>

List of equipments

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3Ø Induction motor</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Permanent Magnet Stepper Motor (PMSM)</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Brushless DC motor</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Universal Motor</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>DC Shunt Motor</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Stepper motor with 8051 interfacing card</td>
<td>1 set</td>
</tr>
<tr>
<td>7</td>
<td>BLDC interface kit with PIC</td>
<td>2 set</td>
</tr>
<tr>
<td>8</td>
<td>PMSM interface kit with PIC</td>
<td>2 set</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>9</td>
<td>Microcontroller motor interface kit (stepper motor, DC motor &amp; Universal motor)</td>
<td>4 set</td>
</tr>
<tr>
<td>10</td>
<td>SCR, TRIAC, MOSFET &amp; IGBT firing Module (6 pulse set)</td>
<td>5 set</td>
</tr>
<tr>
<td>11</td>
<td>PIC module training kit with interface card</td>
<td>4 set</td>
</tr>
<tr>
<td>12</td>
<td>DSP module training kit with interface card</td>
<td>3 set</td>
</tr>
<tr>
<td>13</td>
<td>Rectifier Unit</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Fixed DC power supply</td>
<td>8</td>
</tr>
<tr>
<td>15</td>
<td>CathodeRay Oscilloscope</td>
<td>6</td>
</tr>
<tr>
<td>16</td>
<td>Singlephase Autotransformer</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Three phase Autotransformer</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>Multi meter</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>LCR meter</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>Rheostatsof various ranges</td>
<td>2 sets of 4 value</td>
</tr>
<tr>
<td>21</td>
<td>Worktables</td>
<td>10</td>
</tr>
<tr>
<td>22</td>
<td>DC and AC meters of required ranges</td>
<td>20</td>
</tr>
</tbody>
</table>

EEB432 COMPREHENSION AND VIVA - VOCE

0 0 3 1

EEB 433 DESIGN PROJECT

0 0 9 3
Objective: To develop the objective with creative and analytical skills

OUTCOME
1. To develop the design skills
2. To develop the analytical and innovative skills

Evaluation Procedure

<table>
<thead>
<tr>
<th>Review</th>
<th>Requirement</th>
<th>Weightage in Internal</th>
<th>Weightage in External</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zeroth Review</td>
<td>Title selection</td>
<td>-</td>
<td></td>
<td>At the end of 2 week from the start of semester</td>
</tr>
<tr>
<td>First Review</td>
<td>Literature review, Proposal for the project</td>
<td>10 %</td>
<td></td>
<td>At the end of 5 week from the start of semester</td>
</tr>
<tr>
<td>Second Review</td>
<td>Mathematical Analysis, Simulation output, Circuit Working</td>
<td>20 %</td>
<td></td>
<td>At the end of 8 week from the start of semester</td>
</tr>
<tr>
<td>Model Review</td>
<td>Final Hardware kit</td>
<td>20%</td>
<td></td>
<td>At the end of 11 week From the start of semester</td>
</tr>
<tr>
<td>University Exam</td>
<td>Final Viva Voce</td>
<td>50%</td>
<td></td>
<td>At the end of 12 week From the start of semester</td>
</tr>
</tbody>
</table>