B. E. SYLLABUS

ELECTRICAL & ELECTRONICS ENGINEERING

V & VI SEMESTER

With
Scheme of Teaching
& Examination
<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Qualification</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Nagesh Prabhu</td>
<td>M.Tech, PhD</td>
<td>Professor &amp; HOD</td>
</tr>
<tr>
<td>2</td>
<td>Dr. Sathyendra Kumar</td>
<td>Ph.D</td>
<td>Professor</td>
</tr>
<tr>
<td>3</td>
<td>K. Vasudeva Shettigar</td>
<td>M.Tech</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>4</td>
<td>Nayana P Shetty</td>
<td>M.Tech</td>
<td>Asst. Prof Gd III</td>
</tr>
<tr>
<td>5</td>
<td>Suryanarayana K</td>
<td>M.Tech (on PhD)</td>
<td>Asst. Prof Gd III</td>
</tr>
<tr>
<td>6</td>
<td>Rajaneesh Acharya</td>
<td>M.Tech</td>
<td>Asst. Prof Gd III</td>
</tr>
<tr>
<td>7</td>
<td>Naveen J</td>
<td>M.Tech</td>
<td>Asst. Prof Gd III</td>
</tr>
<tr>
<td>8</td>
<td>Anitha Marina Colaco</td>
<td>M.Tech</td>
<td>Asst. Prof Gd II</td>
</tr>
<tr>
<td>9</td>
<td>Pradeep Kumar</td>
<td>M.Tech</td>
<td>Asst. Prof Gd II</td>
</tr>
<tr>
<td>10</td>
<td>Latha Shenoy</td>
<td>M.Tech</td>
<td>Asst. Prof Gd II</td>
</tr>
<tr>
<td>11</td>
<td>Mahabaleshwara Sharma</td>
<td>M.Tech</td>
<td>Asst. Prof Gd II</td>
</tr>
<tr>
<td>12</td>
<td>Raksha Adappa</td>
<td>M.Tech</td>
<td>Asst. Prof Gd II</td>
</tr>
<tr>
<td>13</td>
<td>Soumya Rani Mestha</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>14</td>
<td>Md. Abdul Raheman</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>15</td>
<td>Cifha Crecil Dias</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>16</td>
<td>Gururaj K</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>17</td>
<td>Dinesh Shetty</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>18</td>
<td>Ravikiran Rao</td>
<td>M.Tech</td>
<td>Asst. Prof Gd I</td>
</tr>
<tr>
<td>19</td>
<td>Swathi Hatwar</td>
<td>M.Tech</td>
<td>Asst. Prof</td>
</tr>
<tr>
<td>20</td>
<td>Raghavendra Prabhu</td>
<td>B.E (on M.Tech)</td>
<td>Asst. Prof</td>
</tr>
</tbody>
</table>
NMAMIT, NITTE
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Vision
Pursuing excellence in Electrical & Electronics Engineering, creating a research environment to promote innovation and address global challenges.

Mission
To equip students to face global challenges by excelling in professional career and higher education.
To offer high quality graduate and post graduate programs in electrical & electronics engineering.
To promote excellence in research, collaborative activities and contribute to social development with ethical values.

Programme Educational Objectives (PEO)

1. Excel in professional career and / or higher education by acquiring knowledge in mathematical, electrical, electronics and computer engineering principles.
2. Analyze real life problems, design electrical and electronics & multidisciplinary engineering systems and solutions that are technically sound, economically feasible and socially acceptable
3. Inculcate and exhibit ethical values, communication skills and provide supportive and leadership roles in their profession to emerge as excellent professionals and adapt to current trends by engaging in lifelong learning.

Programme Outcomes (PO)

B.E, (E&E) Engineering students will attain the following outcomes at the end of the Programme.

a. An ability to apply knowledge of mathematics, science and engineering fundamentals to electrical & electronics systems.
b. An ability to analyze electrical & electronics engineering problem, identify and formulate the appropriate solution.

c. An ability to design and conduct experiments, as well as to analyze, interpret and validate data.

d. An ability to investigate and design a system, component or process to meet desired needs within realistic constraints.

e. An ability to use emerging Technologies, skills, and modern tools necessary for practicing Electrical Engineering.

f. An ability to identify, formulate and solve electrical engineering problems and contribute effectively for the development of the society.

g. An ability to engage in sustainable design, keeping legal, social, environmental, health and safety issues.

h. An understanding of professional and ethical responsibility.

i. An ability to function in multidisciplinary teams.

j. An ability to communicate effectively.

k. An understanding of economical aspects of electrical & electronics engineering and management principles to manage the projects and finance.

l. An ability to strengthen the knowledge and understanding of electrical & electronics engineering systems by engage in lifelong learning.
# DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
## SCHEME OF TEACHING

### V Semester

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Code</th>
<th>Subject</th>
<th>L-T-P</th>
<th>SS</th>
<th>Credits</th>
<th>CIE</th>
<th>SEE</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>12EE501</td>
<td>Linear Integrated Circuits</td>
<td>4-0-0</td>
<td></td>
<td>4</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>12EE502</td>
<td>Digital signal processing</td>
<td>3-2-0</td>
<td></td>
<td>4</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>12EE503</td>
<td>Linear Control Systems</td>
<td>3-2-0</td>
<td></td>
<td>4</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>4.</td>
<td>12EE504</td>
<td>Power Electronics</td>
<td>4-0-0</td>
<td></td>
<td>4</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>5.</td>
<td>12EE505</td>
<td>Transmission and Distribution</td>
<td>4-0-0</td>
<td></td>
<td>4</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>6.</td>
<td>12EE506</td>
<td>Transformers and Induction Machines Laboratory</td>
<td>0-0-3</td>
<td></td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>7.</td>
<td>12EE507</td>
<td>Circuits, Measurements and Controls Laboratory</td>
<td>0-0-3</td>
<td></td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>8.</td>
<td>12EE51X</td>
<td>Computer Organization</td>
<td>3-0-0</td>
<td></td>
<td>3</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>511 Electrical Engineering Materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>512 Electronic Instrumentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>513 Digital System design using VHDL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>21-4-6</td>
<td>04</td>
<td>27</td>
<td>400</td>
<td>400</td>
<td>800</td>
</tr>
</tbody>
</table>

Total marks: 800
<table>
<thead>
<tr>
<th>Sl.</th>
<th>Code</th>
<th>Subject</th>
<th>L-T-P</th>
<th>SS</th>
<th>Credits</th>
<th>CIE</th>
<th>SEE</th>
<th>Total marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>12EE601</td>
<td>Power Systems Analysis &amp; Stability</td>
<td>4-0-0</td>
<td>**4</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>12EE602</td>
<td>Switchgear and Protection</td>
<td>4-0-0</td>
<td>**4</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>12EE603</td>
<td>Microcontrollers</td>
<td>4-0-0</td>
<td>**4</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>12EE604</td>
<td>Power Electronics Laboratory</td>
<td>0-0-3</td>
<td>**2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>12EE605</td>
<td>Microcontrollers Laboratory</td>
<td>0-0-3</td>
<td>**2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>12EE606</td>
<td>Linear Systems Laboratory</td>
<td>0-0-3</td>
<td>**2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>12EE607</td>
<td>IGW*</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>12EE61x</td>
<td>611 Illumination Technology</td>
<td>3-0-0</td>
<td>**3</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>612 Electrical Machine Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>613 Fuzzy Logic Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>614 Operations Research</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>12EE62x</td>
<td>621 Testing &amp; Commissioning of Electrical Equipments</td>
<td>3-0-0</td>
<td>**3</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>622 Renewable Energy Sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>623 Advanced Control Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>624 Advanced Power Electronics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>**Total</td>
<td></td>
<td><strong>18-0-9</strong></td>
<td><strong>04</strong></td>
<td><strong>24</strong></td>
<td><strong>450</strong></td>
<td><strong>400</strong></td>
<td><strong>850</strong></td>
</tr>
</tbody>
</table>

* IGW will be held for one week during specified slot in the semester and will be a non-credit mandatory course.
LINEAR INTEGRATED CIRCUITS

Subject Code : 12EE501
Credits : 4
Hrs / Week : 4
Total Hours : 52

Prerequisite: Basic Electronics (1st Year), Analog Electronics Circuits (3rd sem)
Objectives of the course: To familiarize the working, characteristics and application of Operational amplifier
Outcome / Expectations: Students will know the application of Operational amplifier based circuits.

UNIT - I
OPERATIONAL AMPLIFIER

OP-AMP as an AC Amplifier:
Capacitor Coupled Voltage Follower, High Zin capacitor coupled voltage follower, capacitor coupled non-inverting amplifier, High Zin capacitor coupled non-inverting amplifier, Capacitor coupled inverting amplifier,

7 Hrs

UNIT - II
Setting upper cut-off frequency, capacitor coupled difference amplifier, use of single polarity supply.

3 Hrs

OP-AMP Frequency Response and Compensation:
Op-Amp circuit stability, frequency and phase response, frequency compensating methods, Manufacturer’s recommended compensation, op-amp circuit bandwidth, slew rate effects, stray capacitance effects, load capacitance effects, Zin Mod compensation, Circuit stability precautions.

8 Hrs

UNIT - III
Signal Processing Circuits:
Precision Half wave and full wave rectifiers, limiting circuits, Clamping circuits, peak detectors, sample and hold circuits. V/F and F/V Converters.

5 Hrs

OP-AMP Non linear Circuits:
Op-Amps in switching circuits, crossing detectors, inverting Schmitt trigger circuits, Non-inverting circuits, Astable multivibrators, Monostable multivibrators. op-amp based SCR triggering circuit.

5 Hrs
UNIT - IV
Active Filters
First and Second order high pass and low pass filters. Band pass filter, Band stop filters. Higher order filters. 6Hrs

Specialized IC Applications:
Universal active filters, Phase locked loops, Power amplifiers. 3 Hrs

UNIT - V
555 TIMER - Monostable and Astable multivibrators and applications, 3Hrs

DC-Voltage Regulators:
Voltage regulator basics, Voltage follower regulator, adjustable output regulator, Precision voltage regulator, Integrated Circuit voltage Regulator. 8 Hrs

TEXT BOOKS:
1. David A Bell, Operational Amplifier and Linear IC’s, PHI
2. Ramakanth Gayakwad, Operational Amplifiers and Linear IC’s — PHI / Pearson Education.

REFERENCE BOOKS:
1. Roy Choudhry, Operational amplifiers and Linear Integrated circuits – New Age International.

DIGITAL SIGNAL PROCESSING
Subject Code : 12EE502 Credits : 03+01
Hrs / Week : 3-2-0 Total Hours : 39

Prerequisite: Understanding basic linear-system concepts, linear time-shift invariance, system functions, Laplace transforms, and z-transforms. Representation of digital filters as difference equations, signal flow graphs, z-transform system function, poles and zeroes. Understanding Fourier transform properties in continuous and discrete domains with basic Mathematics.

Objective: To familiarize application of basic properties of time-invariant linear systems understanding sampling, aliasing, convolution, filtering concepts and explaining the above in time and frequency domain representations. Understanding and discussing
digital filters in the z-domain. Use of FFT for convolution, de-
convolution, and linear filtering Implementation, application and
evaluating simple DSP applications in MATLAB

**Outcome /Expectation:** Students will basic signal-processing principles and FT, FFT, and Filter design. Students also will gain practical experience from numerical experiments in MATLAB-based programming assignments

**Note:** Lecture hours indicated is for teaching theoretical concepts. Illustrative examples and numerical problems are to be worked out in tutorial classes.

**UNIT - I**

**SIGNALS AND SYSTEMS** : Basic elements of digital signal Processing –Concept of frequency in continuous time and discrete
time signals –Sampling theorem – Discrete time signals. Discrete time
systems – Analysis of Linear time invariant systems – Z transform –
Convolution and correlation.  

8 Hrs

**UNIT - II**

**FAST FOURIER TRANSFORMS** : Introduction to DFT – Efficient
computation of DFT Properties of DFT – FFT algorithms – Radix-2
and Radix-4 FFT algorithms – Decimation in Time – Decimation in
Frequency algorithms – Use of FFT algorithms in Linear Filtering and
correlation.  

8 Hrs

**UNIT - III**

**IIR FILTER DESIGN** : Structure of IIR – System Design of
Discrete time IIR filter from continuous time filter – IIR filter design
by Impulse Invariance. Bilinear transformation – Approximation
derivatives – Design of IIR filter in the Frequency domain.  

8 Hrs

**UNIT - IV**

**FIR FILTER DESIGN** : Symmetric & Antisymteric FIR filters –
Linear phase filter – Windowing technique – Rectangular, Kaiser
windows – Frequency sampling techniques – Structure for FIR
systems.  

7 Hrs

**UNIT - IV**

**FINITE WORD LENGTH EFFECTS** : Quantization noise –
derivation for quantization noise power – Fixed point and binary
floating point number representation – comparison – over flow error –
truncation error – co-efficient quantization error - limit cycle
oscillation – signal scaling – analytical model of sample and hold
operations – Application of DSP – Model of Speech Wave Form –
Vocoder.  

8 Hrs
TEXT BOOK:

REFERENCE BOOKS:

LINEAR CONTROL SYSTEMS

Subject Code : 12EE503  Credits : 03+01
Hrs / Week : 3-2-0  Total Hours : 39

Pre-requisites: Differential calculus, Laplace transforms, Complex number theory, Matrix algebra

Objectives: To understand the concept of mathematical modeling of linear systems, represent them in block diagram ad signal flow graphs, understand the concept of stability and methods of determining stability of linear systems.

Outcome / Expectation: Students will know the basics of control system, its modeling and application in various electrical concepts.

Note: Lecture hours indicated is for teaching theoretical concepts. Illustrative examples and numerical problems are to be worked out in tutorial classes.

UNIT - I
Modeling of Systems: The control system, Mathematical models of physical systems – electrical Mechanical, electro-mechanical systems, (Mechanical accelerometer, Levered systems excluded), Rotational systems, Gear trains, Electrical systems, Analogous systems, Introduction to state space modeling of simple systems  8 Hrs
UNIT - II
Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded)  

UNIT - III

UNIT - IV
Frequency domain analysis: Introduction, Correlation between time and frequency response, Bode plots, All pass, minimum phase systems & non-minimum phase systems, Assessment of relative stability using Bode Plots, determination of transfer functions from bode plots.  

UNIT - V
Polar plots, Nyquist Criteria: Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist plots Compensators, lead lag networks, Controllers P, PI, PID (qualitative analysis)  

TEXT BOOK :  

REFERENCE BOOKS:  

POWER ELECTRONICS

Subject Code : 12EE504
Credits : 4
Hrs / Week : 4
Total Hours : 52

Pre-requisites: Basic Electronics, Analog Electronics, Network Theory

Objectives: To understand the working of various Power Semiconductor devices and to study the driving and commutation circuits. To understand the use of these power electronics devices in rectifier, choppers, voltage controllers, and in inverter circuits.

Outcome / Expectation: Students will know the working principle different power electronic devices, its applications in various power electronic circuits.

UNIT - I


UNIT - II

UNIT - III
AC Voltage Controllers: Introduction. Principle of ON-OFF and phase control. Single-phase bidirectional controllers with resistive and inductive loads. 5 Hrs


UNIT - IV

UNIT - V

Text Book:

References
TRANSMISSION AND DISTRIBUTION

Subject Code : 12EE505  Credits : 4
Hrs / Week  : 4  Total Hours : 52

Pre-requisites: Electric Power Generation, Switch gear and protection,

Objectives: To understand the basic concepts and technology of Electrical energy transmission and distribution

Outcome / Expectation: Students will know the concepts of electric power transmission and distribution networks.

UNIT - I
Typical transmission & distribution systems scheme: Standard voltages for transmission. Advantage of high voltage transmission. Feeders, distributors & service mains. 5 Hrs
Overhead transmission lines: sag calculation in conductors a) suspended on level supports b) support at different levels. Effect of wind & ice tension & sag at erection. Stringing chart. 5 Hrs

UNIT - II
Self Study Topics - {Corona: Phenomena, expression for disputative & visual critical voltages & corona power loss} 4 Hrs

Insulators: Types, potential distribution over a string of suspension insulators. String efficiency & methods of increasing strings efficiency, testing of insulators. insulation coordination – need and principle (qualitative). 6 Hrs

UNIT - III
Self Study Topics - {Underground cables: Types, material used, insulation resistance, thermal rating of cables, charging current, grading of cables, capacitance grading & inter sheath grading, testing of cables.} 6 Hrs
Distribution: radial & ring main AC distribution systems, calculation for concentrated loads. 6 Hrs

UNIT - IV
Line parameters: calculation of inductance of single phase, 3phase lines with equilateral & unsymmetrical spacing. Inductance of composite conductor lines. Capacitance-calculation for two wires &
three phase lines, capacitance calculation for two wire three-phase line with equilateral & unsymmetrical spacing.  

10 Hrs

UNIT - V
Characteristics & performance of power transmission lines: Short tr.-lines, medium tr.-lines, nominal T & Pi representation of long lines and equivalent T & PI network representation of long Tr.-lines. ABCD constants. Power flow through a transmission line.  

10 Hrs

Text Books:

Reference Books:

TRANSFORMERS AND INDUCTION MACHINES LABORATORY

Subject Code : 12EE506  
Credits : 2  
Hrs / Week : 0-0-3

2. Sumpner’s test.
3. Parallel operation of two dissimilar (different KVA) 1-phase transformers.
4. Polarity test & connection of 3 single phase transformers in star – delta and determination of efficiency & regulation – for balanced direct loading for UPF.
5. Scott connection- for balanced and unbalanced two phases UPF loads.
8. Obtain the equivalent circuit diagram of a 3-phase I.M. & from equivalent circuit diagram obtain its performance evaluation.
9. Speed control of 3-phase induction motor- stator voltage control & rotor resistance control (performance circuits for at least two different voltages/ two rotor resistance values).
10. Load test on- induction generator.
11. Load test on 1 phase induction motor.
12. Speed control of 3-phase induction motor by V/f method

**CIRCUITS, MEASUREMENTS & CONTROLS LABORATORY**

**Subject Code : 12EE507**  
**Credits : 2**  
**Hrs / Week : 0-0-3**

Total of 12 experiments have to be conducted with at least 4 experiments in each module

**Module 1:**
1. Verification of Superposition and Reciprocity theorems
2. Verification of Thevenin’s, Nortons’ and Maximum power transfer theorem
3. Measurement of active and reactive power in balanced 3-phase circuit using two-watt meter method
4. Characteristics of series and Parallel resonance
5. Measurement of Capacitance by Schering Bridge
6. Measurement of Inductance by Maxwell’s Bridge

**Module 2:**
7. Measurement of Frequency by Modulated ring and Broken ring method using CRO
8. Determination of ratio & phase angle error in CT.
10. Determination of conversion time and effect of clock frequency on conversion time in ADC 0808
11. DAC 0800

Module 3:
12. Frequency response of Lag, Lead networks
13. DC and AC Servo motor characteristics, Synchro transmitter-receiver pair.
14. Frequency response of Lag-lead networks
15. Performance characteristics of P, PI, and PID controller

COMPUTER ORGANISATION

Subject Code : 12EE511  Credits : 3
Hrs / Week : 3  Total Hours : 39

Prerequisite: Basic Computer concepts.
Objective of the course: To get acquainted with the knowledge of the basic functional blocks of computer and its processing system.
Outcome /Expectation: Students will know the architecture and function of various blocks of computer and its peripherals.

UNIT - 1
Basic Structure of Computer Hardware and Software: Functional units Basic operational Concepts, Bus structures, software, performance: Processor clock, Basic performance equation, Pipelining and superscalar operation. 6 Hrs

Machine Instructions and Programs: Number representation, Arithmetic operation Memory locations and addresses, Memory operations, Addressing modes, Assembly language, Basic input output operation, Stacks and queues, Subroutines, Additional instructions, Encoding of machine Instructions 9 Hrs
UNIT - II

Input Output Organization: Accessing I/O devices, Interrupts: Interrupt hardware, enabling and disabling interrupts, Handling multiple devices Controlling device requests, Direct Memory Access; Bus arbitrations, synchronous bus, Asynchronous bus, Interface circuits, Serial ports. 6 Hrs

The Memory system: Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Asynchronous DRAMs, Synchronous DRAMs, Structure of larger memories, memory system considerations, rambus memory, read only memories: ROM, PROM, EPROM, EEPROM, Flash memory, Cache memories: mapping functions, performance considerations, Hit rate and miss penalty; Virtual memories: addressing translation, secondary storage: magnetic hard disc and Optical disc. 9 Hrs

UNIT - III

Arithmetic: Addition and subtraction of signed numbers, Logic units; Design of fast adders, Carry look ahead addition, Multiplication of positive numbers, signed operand multiplication: Booth algorithm; fast multiplication: Integer division. 5 Hrs

Basic Processing Unit: Some functional concepts: register transfers, performing arithmetic and logical operations, fetching a word from memory; Execution of a complete instructions Branch instructions Multiple bus organizations. 4 Hrs

TEXT BOOK:

REFERENCE BOOKS:
ELECTRICAL ENGINEERING MATERIALS

Subject Code : 12EE512
Hrs / Week : 3
Credits : 3
Total Hours : 39

Prerequisite: Basic Electrical Engineering.

Objective of the course:

Outcome / Expectation:

UNIT - I
CONDUCTING MATERIALS: Review of metallic conduction on the basis of free electron theory Fermi-Dirac distribution – variation of conductivity with temperature and composition, materials for electric resistors- general electric properties; brushes of electrical machines, lamp filaments, fuses and solder. 4 Hrs

SEMICONDUCTORS: Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic materials: Classification of magnetic materials- origin of permanent magnetic dipoles, ferromagnetism, hard and soft magnetic materials magneto materials used in electrical machines, instruments and relays. 5 Hrs

DIELECTRICS: Dielectrics polarization under static fields-electronic ionic and dipolar polarizations, behavior of dielectrics in alternating fields, Factors influencing dielectric strength and capacitor materials. Insulating materials, complex dielectric constant, dipolar relaxation and dielectric loss. 3 Hrs

INSULATING MATERIALS: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators. 4 Hrs

UNIT - II
MATERIALS FOR SPECIAL APPLICATIONS: Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, sintered alloys for breaker and switch contacts. 5 Hrs
MODERN TECHNIQUES FOR MATERIALS STUDIES: Optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic resonance, nuclear magnetic resonance, electron spin resonance and ferromagnetic resonance. 5 Hrs

Introduction Properties and Application of Piezoelectric materials, Electrostrictive materials, Ferromagnetic materials, Magnetosrtictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels 5 Hrs

UNIT - III

Ceramics: properties, application to conductors, insulator & capacitors
Plastics: Thermoplastics, rubber, thermostats, properties. 8 Hrs

TEXT BOOKS:
1. Electrical Engineering Materials by A J. Dekker
2. “An Introduction to Electrical Engineering”- Indulkar C.S. & Thiruvengadam. S.

REFERENCE BOOKS:
1. “Electrical Engineering Materials”-Yu Koritsky, MIR
ELECTRONIC INSTRUMENTATION

Subject Code : 12EE513
Credits : 3
Hrs / Week : 3
Total Hours : 39

UNIT - I

Basic concept of measurement
Introduction, system configuration, problem analysis, basic characteristics of measuring devices, calibration 2 Hrs

Instrumentation amplifiers
Introduction, basic characteristics, DC amplifiers, Instrumentation amplifiers, Isolation amplifiers, Signal conditioning 2 Hrs

Signal generation and processing
Introduction, Sine wave generation, other waveform generators, modulation, signal processing circuits 4 Hrs

Data acquisition and conversion
Introduction, Signal conditioning of the inputs, single channel Data acquisition system, multi channel Data acquisition system, data conversion, digital to analog converter, analog to digital converters, V/F, F/V conversion, Data acquisition system. Multiplexers and sample hold circuits 7 Hrs

UNIT - II

Digital signal transmission and processing
Introduction, data transmission systems, pulse code formats, modulation techniques for digital data transmission, serial data communication, telemetry systems, interfacing and bus standards, 3 Hrs

PC based data acquisition system
PC based instrumentation systems 2 Hrs

Input output devices and displays
Introduction, Analog displays and recorders, digital input output devices, displays, display multiplexing and zero suppression 4 Hrs

General purpose electronic test equipment
Electronic counters, AC millivoltmeters, signal generators- Fixed frequency AF Oscillator, Variable AFO, standard signal generator, AF Sine & square wave generator, function generator and square & pulse
generator, wave analyzers and spectrum analyzers, frequency response analyzer Regulated power supplies, general components  

7 Hrs

UNIT - III
Measurement systems applied to micro and nanotechnology
Microscale sensors, Micro-motion-positioning systems, particle instruments and clean-room technology, partial-pressure measurements in vacuum processes, magnetic levitation systems for wafer conveyors, scanning probe microscopes  

8 Hrs

TEXT BOOK:

REFERENCE BOOK:
2. D. Heifric, William. D. Cooper “Modern Electronic instrumentation & measurement technique PHI

DIGITAL SYSTEM DESIGN USING VHDL
Subject Code : 12EE514 Credits : 3
Hrs / Week : 3 Total Hours : 39

Prerequisite: Basic Electronics, Digital Electronic Circuits
Objective: To familiarize students with hardware description language.
Outcome /Expectation: Students will be able to design and write VHDL code for a given circuit.

UNIT - I
Introduction: Introduction to computer aided design tool for digital systems hardware description language, introduction to VHDL, signal,
variable, constants, data types-scalar, composite, incomplete types, file types, operators, overloading, logical operators, types of delays.

Entity and architecture declaration, introduction to structural modeling, component declarations, introduction to data flow.

Introduction to behavioral modeling, process statements, sequential statements, if-else statements, case statements, loops, null, exit statements, subprograms and packages, generics, generate statements, configuration, guarded statement, block statements, assert, report, attribute.  

**UNIT - II**

VHDL programs on Boolean functions, 1bit adder, 4 bit adder, multiplexers, demultiplexers, encoder, decoder, code converter (gray code), comparators, shift registers counters.

Design of networks for arithmetic operators: Design of serial adder with accumulator, state graph for control networks, design of binary multiplier, VHDL code for multiplication of signed binary numbers (2’s compliment multiplier), design of binary multiplier using SM charts, VHDL code for traffic light controller.  

**UNIT - III**

Programmable logic devices: Read Only Memory, Programmable Logic Array, Programmable Array Logic, Other sequential programmable logic devices (PLD), FPGA XILINX 3000 SERIES.

**TEXT BOOKS:**

1. **VHDL Programming by Example** – Douglas L.Perry. fourth edition, Tata McGRAW HILL.

**REFERENCE BOOKS:**

2. **Digital Fundamentals using VHDL** - Floyd, Pearson Education, 2003,
POWER SYSTEMS ANALYSIS & STABILITY

Subject Code : 12EE601
Credits : 4
Hrs / Week : 4
Total Hours : 52

Prerequisite: Basics of Electrical Engineering, Transformer theory, Source transformation, Network reduction technique, Network theorems, Transient behavior of circuit elements, Synchronous machine operation and characteristics, Transmission line theory etc…

Objectives: To study the basic needs of power system, Representation of various power system components, Single line diagram of power system, Impedance diagram, Per Unit representation of power system. Study of Symmetrical components for the analysis of unsymmetrical faults. Analysis of Symmetrical faults. Study of stability problems in power system.

Outcome / Expectation: Students will be able to analyze the integrated power system networks

UNIT - I

REPRESENTATION OF POWER SYSTEM COMPONENTS:
Circuit models of Transmission line, Synchronous machines, Transformer and Load. One line diagram, Impedance diagram, Per Unit notation, Selection and change of base for Per Unit quantities, Per Unit Impedance diagram of power system. 10 Hrs

UNIT - II

SYMMETRICAL 3 PHASE FAULTS: Short Circuit currents and reactance of Synchronous machines, Short circuit current calculations of unloaded and loaded Generators and Power Systems, Short circuit current computation through Thevinin’s theorem, Selection of circuit breakers. 10 Hrs

UNIT – III

SYMMETRICAL COMPONENTS: Symmetrical component transformation, Resolution of unbalanced phasors into their symmetrical components and vice-versa, Power in terms of symmetrical components, Phase shift of symmetrical components in Star – Delta transformer bank. Positive, Negative and Zero Sequence impedances and Sequence networks of power system elements (Transmission line, Synchronous machine and Transformer). 12 Hrs
UNIT - IV
UNSYMMETRICAL FAULTS: Symmetrical component analysis of Unsymmetrical faults, Line-To-Ground (L-G), Line-To-Line (L-L), Double Line-To-Ground (L-L-G) faults on an Unloaded Alternator and Power System with and without fault impedance and connections of sequence networks. Open conductor faults in power systems. **10 Hrs**

UNIT - V

TEXT BOOKS:

REFERENCE BOOKS:

SWITCHGEAR AND PROTECTION

Subject Code : **12EE602**
Credits : **3**
Hrs / Week : **4**
Total Hours : **52**

Pre-requisites: Basic Electrical Engineering, Electrical Measurements.

Objectives: To familiarize the basic electrical switchgears and protection devices.

Outcome /Expectation: Students will know the operation, working applications of various switchgears and protective elements.

UNIT - I
Self Study Topics: {
Switches and fuses: Isolating switch, load breaking switch, Fuse law, cut-off characteristics, Time current characteristics, fuse material, HRC fuse, liquid fuse, Application of fuse.} **5 Hrs**
**Grounding Systems:** Introduction, resistance grounding systems, neutral grounding, ungrounded system, resonant grounding, solid grounding, reactance grounding, resistance grounding, earthing transformer, neutral grounding transformer  

**UNIT - II**


**UNIT - III**

**Circuits Breakers:** Air Circuit breakers – Air break and Air blast Circuit breakers, oil Circuit breakers - Single break, double break and minimum OCB SF6 breaker - Preparation of SF6 gas, Puffer and non Puffer type of SF6 breakers

**Vacuum circuit breakers** - Construction, principle of operation, advantages and disadvantages of different types of Circuit breakers,

**Self Study Topics:** {Testing of Circuit breakers, Unit testing, synthetic testing short circuit test lay out.}

**UNIT - IV**

**Protective Relaying:** Requirement of Protective Relaying, Zones of protection, primary and backup protection, Essential qualities of Protective Relaying, Classification of Protective Relays.

**Induction type relay:** Non-directional and directional over current relays, IDMT and Directional characteristics. Differential relay – Principle of operation, percentage differential relay, bias characteristics, distance relay – Three stepped distance protection,
Impedance relay, Reactance relay, Mho relay, Buchholz relay, Negative Sequence relay, Microprocessor based over current relay – block diagram approach.  

8 Hrs

UNIT - V

Protection Schemes:

6 Hrs

Self Study Topics: {Induction motor protection – protection against electrical faults such as phase fault, ground fault, and abnormal operating conditions such as single phasing, phase reversal, overload.}

4 Hrs

TEXT BOOKS:
2. Badriram & Viswa Kharma “Power System Protection & Switchgear”, TMH, (GS)

REFERENCE BOOKS:
1. Chakraborty, Soni, Gupta & Bhatnagar, “A Course in Electrical power” Dhanapatirai. Publication,
MICROCONTROLLERS

Subject Code : 12EE603
Credits : 4
Hrs / Week : 4
Total Hours : 52

Course Learning Objectives:
Intel 8051 - The Intel MCS-51 (commonly referred to as 8051) is a Harvard architecture, CISC instruction set, single chip microcontroller (μC) series which was developed by Intel in 1980 for use in embedded systems. One feature of the 8051 core is the inclusion of a boolean processing engine which allows bit-level boolean logic operations to be carried out directly and efficiently on select internal registers and select RAM locations. This feature helped cement the 8051's popularity in industrial control applications because it reduced code size by as much as 30%. Another feature is the inclusion of four bank selectable working register sets which greatly reduce the amount of time required to complete an interrupt service routine. Various Programming examples will be considered to explore other features of 8051.

TI MSP430 - The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultralow power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

Prerequisite: Digital Electronic Circuits

Course Outcome /Expectation: Students will be able to design, program and interface microcontroller system for a given problem.

UNIT - I

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software. 2 Hrs

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks. 3 Hrs

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing, Register
addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 5 Hrs

UNIT - II

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. 4 Hrs

8051 programming: Assembler directives, Assembly language programs, C Programming, Time delay calculations. 6 Hrs

UNIT - III

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C. 6 Hrs

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232 (DB-9 only), Serial communication Programming in assembly and C. 6 Hrs

UNIT - IV

Motivation for MSP430 microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design). MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families. 3 Hrs

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins. 2 Hrs

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA. 2 Hrs

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low power programming and Interrupt. 2 Hrs

UNIT - V

8051 Interfacing and Applications: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing, DC motor interfacing and PWM. 6 Hrs
Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.       2 Hrs

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces. Interfacing LED with MSP430.       3 Hrs

TEXT BOOKS:

Reference Books:
2. MSP430 Teaching CD-ROM, Texas Instruments, 2008 (can be requested http://www.uniti.in )

POWER ELECTRONICS LABORATORY
Subject Code : 12EE604          Credits : 2
Hrs / Week     : 0-0-3

1. Static characteristics of SCR.
2. Static characteristics of MOSFET and IGBT.
3. SCR turn-on circuit using synchronized UJT relaxation oscillator.
4. SCR Digital triggering circuit for a single -phase controlled rectifier /A.C. voltage controller.
6. A.C. voltage controller using TRIAC and DIAC combination connected to R and R-L loads.
7. Speed control of a separately excited D.C. motor using an IGBT/ MOSFET chopper.
8. Speed control of a stepper motor.
10. MOSFET/IGBT based single-phase full-bridge inverter connected to R load.
11. Auxiliary and LC commutation circuit.
12. DSP based speed control of motor

MICROCONTROLLERS LABORATORY

Subject Code : 12EE605
Credits : 02
Hrs / Week : 0-0-3
Total Hours : 39

I. PROGRAMMING
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits
1. Arithmetic operations – bit addressable).
2. Counters.
3. Boolean & Logical Instructions (Bit manipulations).
4. Conditional CALL & RETURN.
5. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal -
6. HEX .
7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430

II. INTERFACING:
Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.
8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.
9. Alphanumeric LCD panel and Hex keypad input interface to 8051.
10. External ADC and Temperature control interface to 8051.
11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

LINEAR SYSTEMS LABORATORY

Subject Code : 12EE606
Credits : 02
Hrs / Week : 0-0-3
Total Hours : 39

1. Simulation of a typical second order system and determination of step response and frequency response to evaluate time domain specifications & frequency domain specifications
2. Simulate a D. C. position control system using MATLAB and obtain its step response.
3. Obtain the phase margin and gain margin for a given transfer function by drawing bode plots and verify the same using MATLAB.
4. To draw the root loci for a given transfer function and verification of breakaway point and imaginary axis cross axis- using MATLAB.
5. To draw Polar plot, Nyquist plot for a given transfer function and verification of stability
6. Verification of Sampling theorem and obtaining Impulse response of a given system
7. Linear convolution of two given sequences by direct method and using DFT and IDFT
8. Circular convolution of two given sequences by direct method and using DFT and IDFT
9. Solving a given difference equation.
10. Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum.
11. Design and implementation of FIR filter to meet given specifications.
12. Design and implementation of IIR filter to meet given specifications
ILLUMINATION TECHNOLOGY

Subject Code : 12EE611
Credits : 3
Hrs / Week : 3
Total Hours : 39

Prerequisite: Basic Electrical Engineering, Basics of Optics.

Objective: To study various lighting system, its design and selection.

Outcome/ Expectation: Students will be able to design and select various lighting schemes for interior and exterior lighting systems.

UNIT - I


Inter relation between the various photometric quantities –Luminous efficacy, spectral eye sensitivity curve-Light watt-Brightness-Luminous existence-Radiometric quantities & units-point by point method of luminance calculations –simple problems. 15 Hrs

UNIT - II

Artificial light sources: construction- principle of operation- luminous efficiency- lamp life & color characteristics of incandescence, Tungsten halogen, fluorescent, High pressure mercury vapor, High Pressure sodium vapor and metal halide lamps- new trends in lamp technology. 15 Hrs
UNIT - III
Interior lighting design: Lighting design objectives-safely and health performance-appearance & comport lighting design flow chart.
Lighting for commercial and public buildings such as offices, hotels teaching establishments and hospital lighting
Lighting for industrial buildings, low & high bay area’s general lighting designs.
Lighting for display-Shops & super markets, art galleries, museum lighting, lumen method of calculations-simple problems 9 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

ELECTRICAL MACHINE DESIGN
Subject Code : 12EE612
Credits : 3
Hrs / Week : 3
Total Hours : 39

UNIT – I
PRINCIPLES OF ELECTRICAL MACHINE DESIGN:
Introduction, considerations for the design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. 6 Hrs

DESIGN OF DC MACHINES:
Output equation, choice of specific loadings, and choice of number of poles design of Main dimensions of the DC machines, Design of armature slot dimensions, commutators and brushes, magnetic circuit estimation of ampere turns, design of yoke and pole, field windings – shunt, series and interpoles. 7 Hrs
UNIT – II
DESIGN OF TRANSFORMERS (SINGLE PHASE AND THREE PHASE):
Output equation for single phase and three phase transformer, choice of specific loadings, expression for volts/turn, determination of main dimensions of the core, types of windings and estimation of number of turns and cross sectional area of Primary and secondary coils, estimation of no load current, expression for leakage reactance and voltage regulation. Design of tank and cooling tubes (round and rectangular) 8 Hrs

UNIT - IV
DESIGN OF INDUCTION MOTORS:
Output equation, Choice of specific loadings, main dimensions of three phase induction motor, Stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of Rotor bars and end ring, design of Slip ring induction motor, estimation of No load current, leakage reactance, and circle diagram 8 Hrs

UNIT - V
DESIGN OF SYNCHRONOUS MACHINES:
Output equation, Choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machines. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, design of the field winding, design of rotor of non-salient pole machine. 10 Hrs

TEXT BOOKS:
1) A.K.Sawhney, “A course in electrical machine design”
2) V. N. Mittle, “Design of electrical Machines”, 4/e edition

REFERENCE BOOKS:
1) M.G.Say, “Performance and design of AC Machines”.
2) R.K.Aggarwal, “Principles of electrical machine design”
3) Sanmug Sundarm, ”Design data handbook”
FUZZY LOGIC CONTROL

Subject Code : 12EE613
Credits : 3
Hrs / Week : 3
Total Hours : 39

UNIT - I
1) Introduction: Background, Uncertainty and imprecision, Statistics and random processes, Uncertainty in information, Fuzzy sets and membership, Chance versus ambiguity.  
   3 Hrs
2) Fuzzy sets, fuzzy set operations, Properties of fuzzy sets,  
   2 Hrs
3) Fuzzy relations- cardinality of fuzzy relations, operations on fuzzy relations, properties of fuzzy relations, Fuzzy Cartesian product and composition.  
   3 Hrs
4) Tolerance and equivalence relations- fuzzy tolerance and equivalence relations  
   3 Hrs
5) Membership functions: Features of the membership function, Standards forms and boundaries, fuzzification, Membership value assignments- intuition, inference, Rank ordering, Angular fuzzy sets  
   5 Hrs

UNIT - II
6) Fuzzy to crisp conversions: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods  
   7 Hrs
7) Fuzzy arithmetic: Functions of fuzzy sets-extension principle, Fuzzy transform(Mapping), Practical considerations  
   3 Hrs
8) Fuzzy logic, Approximate reasoning, other forms of implication operation.  
   2 Hrs
   3 hrs

UNIT - III
10) Nonlinear simulation using Fuzzy systems, Fuzzy associative memory, Fuzzy Control Systems: Review of Control systems theory, simple fuzzy logic controllers, general fuzzy logic controllers, special form of fuzzy logic control system models, examples of fuzzy control system design, industrial application of fuzzy logic- control of blood pressure during anesthesia, customer adaptive fuzzy control of home heating system, adaptive fuzzy systems.  
   8 Hrs
TEXT BOOKS:

OPERATIONS RESEARCH
Subject Code : 12EE614 Credits : 03
Hrs / Week : 3 Total Hours : 39
Prerequisite:
Objective:
Outcome/ Expectation:

UNIT - I
Introduction, definition, OR models characteristics and phases of OR. Modeling with linear programming: Two variable LP model, Graphical LP solution, model in equation form graphical to algebraic solution, simplex method artificial starting solution, Special cases in simplex method, sensitivity analysis 9 Hrs
DUALITY: Definition of the dual problem primal to dual relationships, economic interpretation of duality, additional implex algorithms. 5 Hrs

UNIT - II
TRANSPORTATION MODEL: definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model, traveling salesman problem 9 Hrs
ADVANCED LINEAR PROGRAMMING: revised simplex method, dual simplex method, Bounded variable algorithm, parametric linear programming. 6 Hrs

UNIT - III
GAME THEORY: Formulation of two - person, zero sum games, solving simple games, the Max-min min-max principles, graphical solution procedure, solving by linear programming 5 Hrs
PERT & CPM TECHNIQUES: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crashing of simple networks, PERT calculations.  

5 Hrs

TEXT BOOKS:

REFERENCE BOOK:
1. “Optimization Techniques”-S. S. Rao,

TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT

Subject Code : 12EE621  
Credits : 3
Hrs / Week : 3  
Total Hours : 39

Prerequisite:
Objective:
Outcome/ Expectation:

UNIT - I

TRANSFORMERS:

a. SPECIFICATION:

b. Installation: Location & sites, selection & design of foundation details(like bolts size, their number, etc,) code of practice for terminal plates, polarity & phase Sequence, oil tanks, drying of windings with & without oil, general inspection. 3 Hrs

c. Commissioning tests: Following tests as per national & International Standards, volt ratio test, earth resistance oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature raise test. 3 Hrs

d. Specific Tests: Determination of performance curves like efficiency, regulation etc, and determination of mechanical stress under normal &abnormal conditions. 2 Hrs
SYNCHRONOUS MACHINES:

a. SPECIFICATIONS:
b. Installation: Physical inspection, rating nameplate details, foundation details, alignments excitation systems, cooling and control gear, drying out.
c. Commissioning Tests: Insulation, Resistance measurement of armature & field wings, waveform & telephone interference factors, line charging capacity. 3 Hrs
d. Performance tests: Various tests to estimate the performance for generator operations slip maximum lagging currents, maximum reluctance power tests, sudden short circuit tests, transient & sub transient parameters, measurements of sequence impedances, capacitive reactance, and separation of losses, temperature raise test, and retardation tests 3 Hrs
e. Factory tests: Gap length, magnetic centrity balancing vibrations, bearing performance. 3 Hrs

UNIT - II

MAINTENANCE SCHEDULE:
INDUCTION MOTORS:
a. Specifications for different types of motors, Duty, el L.P. protection. 3 Hrs
b. Installation: Location of the motors (including the foundation details) & its control apparatus, shift & alignment for various coupling, fitting of pulleys & coupling, drying of windings. 3 Hrs
c. Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing. 3 Hrs

d. Electrical Tests: Insulation test, earth resistance, high voltage test, starting up failure to speed up to take the load type of test, routine test, factory test and site test (in accordance with ISI code) 3 Hrs
d. Specific Tests: Performance & temperature raise tests, stray load losses, shaft elements, and re-rating & special duty capability. 2 Hrs

UNIT - III

SWITCH GEAR & PROTECTIVE DEVICES
Standards, types, specification, installation, commissioning tests, maintenance schedule, type & routine tests. 7 Hrs
TEXT BOOKS:
1) S. Rao, Testing & Commissioning of electrical equipment
2) B. V. S. Rao, Testing & Commissioning of electrical equipment

REFERENCE BOOKS:
1) Relevant Bureau of Indian Standards
2) H. N. S. Gowda, “A handbook on operation and Maintenance of transformers”

RENEWABLE ENERGY SOURCES

Subject Code : 12EE622  Credits : 3
Hrs / Week : 3  Total Hours : 39

Prerequisite:
Objective:
Outcome/ Expectation:

UNIT - I
Energy Sources: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario.  

3 Hrs


5 Hrs


4 Hrs


5 Hrs

UNIT - II

4 Hrs


5 Hrs


8 Hrs

UNIT - III
Energy from Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Estimation of Energy – Single basin and Double basin type TPP (no derivations. Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitation of OTEC.  

5 Hrs


3 Hrs

TEXT BOOKS:
REFERENCE BOOKS:

ADVANCED CONTROL THEORY

Subject Code : 12EE623 Credits : 3
Hrs / Week : 3 Total Hours : 39

Prerequisite: Linear Control System, Engineering Mathematics

Objective: To study the state space representation of the system and to develop its model in different forms.

Outcome / Expectation:

UNIT - I
State variable analysis & design: Introduction, concept of state, state variables & state model, state model of linear systems, linearization of state equations. 2 Hrs
State space representation using physical variables, phase variables & canonical variables 7 Hrs
Derivation of transfer function from state model, diagonalisation, Eigen values, Eigen vectors, generalized Eigen vectors. 6 Hrs

UNIT - II
Solution of state equation, state transition matrix & its properties, computation using Laplace transformation, Cayley-Hamilton method. Concept of controllability & observability, methods of determining the same.
Pole placement techniques: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement. Ackerman’s Formula 15 Hrs
UNIT - III
Introduction to non-linear systems, special characteristics of non-linear system- amplitude frequency dependencies, jump resonance, limit cycles.
Singular points-classification, stability of nonlinear system, Liapunov’s direct method 9 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

ADVANCED POWER ELECTRONICS

Subject Code : 12EE624  Credits : 3
Hrs / Week : 3  Total Hours : 39

Prerequisite: Power Electronics

Objective: To introduce switched mode power converter concept and to design the same. Also to familiarize working principle of UPS, Solar based power stations and to give design steps to be followed for designing transformers and inductors.

Outcome/ Expectation: Students will be able to select /design various switched mode power converters, transformers, inductors.
UNIT - I

DC-DC switched mode converter topologies: Introduction, Control of dc-dc converters. Buck, Boost, Buck-Boos, Cûk dc-dc converter topologies, Full-bridge dc-dc converter, dc-dc converter comparison, generalized comparison between switched mode and linear dc regulator, dc-dc converter with isolation – flyback converters, other flyback converter topologies, forward converter, push-pull converter, half and full bridge converter. 15 Hrs

UNIT - II

DC-AC switched mode inverters: Basic concept of switch-mode Inverters, single-phase inverter, three phase inverters. SPWM inverter, detailed theory, working principles, modes of operation with circuit analysis, ripple in the inverter output, switch utilization, problems. 8 Hrs

Resonant switch converters: Classification of resonant converter, Resonant switch converter – ZCS, ZVS, ZVS-CV dc-dc converters; Resonant dc-link inverter with ZVS, problems 8 Hrs

UNIT - III

Power line disturbances, Power Conditioner and uninterruptible power supplies, solar power based bidirectional inverter- High frequency inductor and transformers design: specific inductor transformer design, Inductor and transformer design procedure, problems 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
1. Modern power electronics- Cyril Lander