**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
(*Established by Govt. of A.P., Act. No. 30 of 2008*)  
ANANTHAPURAMU – 515 002 (A.P.) INDIA.

----------------------------------------------------------------------------------------------------------

Course Structure for B.Tech-R15 Regulations

### ELECTRICAL & ELECTRONICS ENGINEERING

**B.Tech III-I Semester (EEE)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>15A02501</td>
<td>Electrical Measurements</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>15A04509</td>
<td>Linear &amp; Digital IC Applications</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>15A02502</td>
<td>Electrical Power Transmission Systems</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>15A02503</td>
<td>Power Electronics</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>15A02504</td>
<td>Electrical Machines – III</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>15A04510</td>
<td>MOOCs I</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15A02505</td>
<td>Digital Circuits and Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Networks Signals and Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>15A02506</td>
<td>Electrical Machines Laboratory – II</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>15A02507</td>
<td>Electrical Measurements Laboratory</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>15A99501</td>
<td>Audit course – Social Values &amp; Ethics</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total:** 20 6 10 22
### B.Tech III-II Semester (EEE)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>15A52601</td>
<td>Management Science</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>15A02601</td>
<td>Power Semiconductor Drives</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>15A02602</td>
<td>Power System Protection</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>15A04601</td>
<td>Microprocessors &amp; Microcontrollers</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>15A02603</td>
<td>Power System Analysis</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td><strong>CBCC-I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02604</td>
<td>1) Neural Networks &amp; Fuzzy Logic</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15A02605</td>
<td>2) Programmable Logic Controller &amp; Its</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02606</td>
<td>3) Optimization Techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A01608</td>
<td>4) Intellectual Property Rights</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>15A04607</td>
<td>Microprocessors &amp; Microcontrollers Laboratory</td>
<td>-</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>15A02607</td>
<td>Power Electronics &amp; Simulation Laboratory</td>
<td>-</td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>15A52602</td>
<td>Advanced English Language Communication Skills (AELCS) Laboratory (Audit Course)</td>
<td>-</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>15A02608</td>
<td>Comprehensive Online Examination - II</td>
<td>-</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total:</strong></td>
<td>18</td>
<td>6</td>
<td>12</td>
<td>23</td>
</tr>
</tbody>
</table>

### B.Tech IV-I Semester (EEE)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>15A02701</td>
<td>Electrical Distribution Systems</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>15A04603</td>
<td>Digital Signal Processing</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>15A02702</td>
<td>Power System Operation and Control</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>15A02703</td>
<td>Utilization of Electrical Energy</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td><strong>CBCC-II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02704</td>
<td>a) Modern Control Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02705</td>
<td>b) Switched Mode Power Converters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02706</td>
<td>c) Energy Auditing &amp; Demand Side Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td><strong>CBCC-III</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15A02707</td>
<td>a) Smart Grid</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
### B.Tech IV-II Semester (EEE)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
</table>
| 1.     | 15A02801 15A02802 15A02803 | MOOCS – II  
1. Instrumentation  
2. Power System Dynamics and Control  
3. Industrial Automation & Control | 3 | 1 | - | 3 |
| 2.     | 15A02804 15A04702 15A02805 | MOOCS – III  
1. HVDC Transmission  
2. Embedded Systems  
3. Energy Resources & Technology | 3 | 1 | - | 3 |
| 3.     | 15A02806 | Comprehensive Viva Voce | - | - | 4 | 2 |
| 4.     | 15A02807 | Technical Seminar | - | - | 4 | 2 |
| 5.     | 15A02808 | Project Work | - | | 24 | 12 |
| **Total:** | | | 6 | 2 | 32 | 22 |
Course Objectives:
The objectives of the course are to make the student learn about
- The basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
- The measurement of R, L, and C parameters using bridge circuits.
- The principles of magnetic measurements.
- The principle of working of CRO and its applications.
- The use of Current Transformers, Potential Transformers, and Potentiometers.

UNIT- I
MEASURING INSTRUMENTS
Cathode Ray Oscilloscope- Cathode Ray tube-Time base generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current & Voltage- Lissajous Patterns

UNIT – II
D.C & A.C BRIDGES

UNIT – III
MEASUREMENT OF POWER AND ENERGY
UNIT –IV
INSTRUMENT TRANSFORMERS AND POTENTIOMETERS
A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.

UNIT – V
MAGNETIC MEASUREMENTS

OUTCOMES: The student should have learnt how to
• Use wattmeters, pf meters, and energy meters in a given circuit.
• Extend the range of ammeters and voltmeters
• Measure active power, reactive power, power factor, and energy in both 1-phase and 3-phase circuits
• Determine the resistance values of various ranges, L and C values using appropriate bridges.
• Analyze the different characteristic features of periodic, and aperiodic signals using CRO.
• Use CTs and PTs for measurement of very large currents and high voltages

TEXT BOOKS:

REFERENCE BOOKS:
Course Objective:
- To make the student understand the basic concepts in the design of electronic circuits using linear integrated circuits and their applications. To introduce some special function ICs.
- To be able to use computer-aided design tools for development of complex digital logic circuits.
- To be able to model, simulate, verify, analyze, and synthesize with hardware description languages.
- To be able to design and prototype with standard cell technology and programmable logic.
- To be able to design tests for digital logic circuits, and design for testability.

Learning Outcome:
- Upon completion of the course, students will be able to:
  - Understand the basic building blocks of linear integrated circuits and its characteristics.
  - Analyze the linear, non-linear and specialized applications of operational amplifiers.
  - Understand the theory of ADC and DAC.
  - Able to use computer-aided design tools for development of complex digital logic circuits.
  - Able to model, simulate, verify, analyze, and synthesize with hardware description languages.
  - Able to design and prototype with standard cell technology and programmable logic.
  - Able to design tests for digital logic circuits, and design for testability.

UNIT I
OP-AMP CHARACTERISTICS:
purpose regulator.

UNIT II
TIMERS, PHASE LOCKED LOOPS & D-A AND A-D CONVERTERS:

UNIT III
ACTIVE FILTERS & OSCILLATORS:
Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadrature type, waveform generators- triangular, sawtooth, square wave and VCO.

UNIT IV
INTEGRATED CIRCUITS:
Classification, Chip size and circuit complexity, Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector o/ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.

UNIT V
COMBINATIONAL &SEQUENTIAL CIRCUITS

SEQUENTIAL: Latches, Flip-flops & their conversions. Design of synchronous counters, Decade counter, shift registers & applications, familiarities with commonly available 74XX and CMOS 40XX series of IC counters.

Text Books:
Reference Books:

2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications – Denton J.Daibey, TMH.
Course Objectives:

The objectives of the course are to make the student learn about
- The computation of the parameters of a Transmission line.
- Classification of transmission lines and representation by suitable equivalent circuits
- the various factors that affect the performance of Transmission lines
- The Travelling wave phenomenon on transmission lines.
- Underground cables: construction, types, and grading

UNIT- I
TRANSMISSION LINE PARAMETERS

UNIT- II
PERFORMANCE OF TRANSMISSION LINES:

UNIT- III
MECHANICAL DESIGN OF TRANSMISSION LINES
Overhead Line Insulators: Types of Insulators, String Efficiency and Methods for Improvement, Capacitance Grading and Static Shielding.
Corona: Corona Phenomenon, Factors Affecting Corona, Critical Voltages and Power Loss, Radio Interference.
Sag and Tension Calculations: Sag and Tension Calculations with Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductor, Stringing Chart and Sag Template and Its Applications, Numerical Problems.

UNIT – IV
POWER SYSTEM TRANSIENTS & TRAVELLING WAVES
Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of Lines with Different Types of Conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley’s Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT-V
CABLES

Course Outcomes: At the end of the course the student will be able to
- Compute the transmission line parameters.
- Model a given transmission line.
- Estimate the performance of a given transmission line.
- Analyze the effect of over voltages on transmission lines.
- Explain the construction, types and grading of underground cables and analyze cable performance.

TEXT BOOKS:

REFERENCE BOOKS:

Course Objectives:
The objectives of the course are to make the student learn about
- the basic power semiconductor switching devices and their principles of operation.
- the various power conversion methods, controlling and designing of power converters.
- the applications of Power electronic conversion to domestic, industrial, aerospace, commercial and utility systems etc.
- the equipment used for DC to AC, AC to DC, DC to Variable DC, and AC to Variable frequency AC conversions.

UNIT I
POWER SEMICONDUCTOR DEVICES

UNIT II
PHASE CONTROLLED CONVERTERS
UNIT III
CHOPPERS AND REGULATORS
Commutation Circuits – Time Ratio Control and Current Limit Control Strategies – Step Down and Step up Choppers Derivation of Load Voltage and Currents with R, RL and RLE Loads- Step Up Chopper – Load Voltage Expression– Problems. Study of Buck, Boost and Buck-Boost regulators, buck regulator e.g. TPS54160, hysteretic buck regulator e.g.LM3475, Switching Regulator and characteristics of standard regulator ICs – TPS40200, TPS40210, TPS 7A4901, TPS7A8300

UNIT IV
INVERTERS

UNIT V
AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS

Cyclo Converters – Single Phase Mid Point Cycloconverters with Resistive and Inductive Load (Principle of Operation only) – Bridge Configuration of Single Phase Cycloconverter (Principle of Operation only) – Waveforms

Course Outcomes:
After going through this course, the student acquires knowledge about:
- Basic operating principles of power semiconductor switching devices.
- the operation of power electronic converters, choppers, inverters, AC voltage controllers, and cycloconverters, and their control.
- How to apply the learnt principles and methods to practical applications.

TEXT BOOKS:
REFERENCE BOOKS:
Course Objectives:
The objectives of the course are to make the student learn about
- the construction and principle of working of synchronous machines
- different methods of predetermining the regulation of alternators
- the concepts and computation of load sharing among alternators in parallel.
- the performance characteristics of synchronous motors and their use as synchronous condensers for power factor improvement.
- different types of single phase motors and special motors used in household appliances and control systems.

UNIT – I
SYNCHRONOUS GENERATORS

UNIT – II
REGULATION OF SYNCHRONOUS GENERATORS

UNIT – III
PARALLEL OPERATION OF SYNCHRONOUS GENERATORS
UNIT – IV
SYNCHRONOUS MOTORS

UNIT – V
SINGLE PHASE AND SPECIAL MOTORS

Course Outcomes: At the end of the course the student will be able to
- predetermine the regulation of synchronous generators using different methods.
- Determine how several alternators running in parallel share the load on the system.
- Analyze the performance characteristics of synchronous motors.
- Make necessary calculations for power factor improvement using synchronous condenser.
- Choose specific 1-phase motor and/or special motors for a given application.

TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes:

Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

UNIT-I

Number System and Boolean Algebra And Switching Functions: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes. Boolean algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR

UNIT-II:

UNIT III
SEQUENTIAL CIRCUITS

UNIT IV
MEMORY DEVICES

UNIT V
SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS
Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

TEXT BOOKS:
REFERENCE BOOKS:
3. Digital Logic Design - Ye Brian and HoldsWorth, Elsevier
Course Objectives: The objectives of the course are to make the students learn about
- Basic characteristics of circuit elements
- How to compute two port parameters
- Study of graph theory and analysis of electrical networks
- Application of Laplace transforms to analyse the frequency response
- Application of Fourier transforms to electrical circuits excited by non-sinusoidal sources.

Unit – I Introduction
Network elements and sources – linearity and nonlinearity – Distributed and lumped parameters – Analysis of resistive networks

Unit – II Two port networks
Two port parameters short and open circuit – Problems – locus diagrams – Driving point immittance functions – Two element synthesis- Problems

Unit – III Introduction to signals
Types of signals – Laplace transforms – problems – Frequency response – bode plot – poles and zeros

Unit – IV – Graph Theory
Introduction – Concepts of Graph theory – image impedance and iterative impedance – Computer aided analysis of resistive networks – RLC two terminal network

Unit – V Synthesis of Network functions
Parts of Network functions – Problems – Synthesis of two port network – Fourier series – Fourier Transforms

Outcomes: After completion of Course, the student should be able to
- Given network, find the equivalent impedance by the concept of two port network
- Analyse the frequency response of electrical network using Laplace transform
- Apply concepts of Fourier series to simply the electrical network
- Synthesize the network using network functions
References:
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (EEE)   L T P C
0 0 4 2

15A02506 ELECTRICAL MACHINES LABORATORY – II

Course Objective:

- To experiment in detail on Transformers, Induction Motors, Alternators and Synchronous Motors, and evaluate their performance characteristics.

The following experiments are required to be conducted as compulsory experiments:

2. Sumpner’s Test on a Pair of identical Single Phase Transformers
3. Scott Connection of Transformers
4. No-Load & Blocked Rotor Tests on Three Phase Induction Motor
5. Regulation of Three –Phase Alternator by Synchronous Impedance & M.M.F. Methods
7. Equivalent Circuit of Single Phase Induction Motor
8. Determination of Xd and Xq of Salient Pole Synchronous Machine

In addition to the above eight experiments, at least any two of the following experiments are required to be conducted:

1. Parallel Operation of Single Phase Transformers
2. Separation of Core Losses of Single Phase Transformer
3. Brake Test on Three Phase Induction Motor
4. Regulation of Three-Phase Alternator by Z.P.F. and A.S.A Methods

Course Outcomes:

- After going through this laboratory course, the student acquires sufficiently good practical knowledge about the operation, testing, and characteristics of important A.C equipment like transformers, Induction Motors, Alternators and Synchronous Motors.
- The student should also have acquired the knowledge about the fixation of the rating of transformers, induction motors and synchronous machines.
Course Objective: The objectives of the course are to make the students learn about:
- Calibration of various electrical measuring/recording instruments.
- Accurate determination of resistance, inductance and capacitance using D.C and A.C Bridges.
- Measurement of parameters of choke coil

The following experiments are required to be conducted as compulsory experiments:
1. Calibration of Single Phase Energy Meter using Phantom loading method with RSS meter as standard
2. Calibration of Dynamometer Power Factor Meter
3. Crompton D.C. Potentiometer – Calibration of PMMC Ammeter and PMMC Voltmeter
6. Schering Bridge & Anderson Bridge for measurement of Capacitance and Inductance values.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:
10. Calibration of LPF Wattmeter – by Phantom Testing
12. Dielectric Oil Testing Using H.T. Testing Kit
13. LVDT and Capacitance Pickup – Characteristics and Calibration
Course Outcomes: At the end of the course, the student will be able to
- Calibrate various electrical measuring/recording instruments.
- Accurately determine the values of inductance and capacitance using a.c bridges.
- Accurately determine the values of very low resistances.
- Measure reactive power in 3-phase circuit using single wattmeter.
- Determine ratio error and phase angle error of CT.
UNIT - I
Introduction and Basic Concepts of Society: Family and Society: Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

UNIT – II
Activities of NSS, NCC, NYK:
Citizenship: Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.
Youth and Crime: Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice
Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

UNIT – III
Environment Issues: Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).
Health, Hygiene & Sanitation: Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.
Disaster Management: Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.
Civil/ Self Defense: Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

UNIT – IV
Gender Sensitization: Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic
Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiates of NGOs – Awareness, Movements;

UNIT - V
Physical Education: Games & Sports: Health and Recreation – Biological basis of Physical activity – benefits of exercise – Physical, Psychological, Social; Physiology of Muscular Activity, Respiration, Blood Circulation.


TEXT BOOKS:
1. NSS MANUAL
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
10. TOWARDS A WORLD OF EQUALS: A.Suneetha, Uma Bhrugudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu

www.un.org
www.india.gov.in
www.yas.nic.in
http://www.who.int/countries/ind/en/
http://www.ndma.gov.in
http://ayush.gov.in/event/common-yoga-protocol-2016-0
Course Objective: The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.

UNIT –I:

UNIT- II:
Operations Management: Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ & ABC Analysis (Simple Problems)
Marketing Management:

UNIT -III:

UNIT –IV:

UNIT-V:
Contemporary Management Practices: Basic concepts of MIS-Materials Requirement Planning (MRP), Just-In-Time (JIT) System, Total Quality Management (TQM) - Six Sigma

**Course Outcome:** This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
Course Objectives: The objectives of the course are to make the students learn about:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

UNIT – I
CONVERTER FED DC MOTORS
Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics– Problems.

UNIT – II
FOUR QUADRANT OPERATION OF DC DRIVES
Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only)

UNIT – III
CHOPPER FED DC MOTORS
Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics – Problems on Chopper Fed D.C Motors
UNIT – IV
CONTROL OF INDUCTION MOTOR

UNIT – V
CONTROL OF SYNCHRONOUS MOTORS

Course Outcomes: The student should be able to:
- Identify the choice of the electric drive system based on their applications
- Explain the operation of single and multi quadrant electric drives
- Analyze single phase and three phase rectifiers fed DC motors as well as chopper fed DC motors
- Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors and Synchronous motors with closed loop, and open loop operations.

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives: The objectives of the course are to make the students learn about:

- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from over voltages

UNIT – I
RELAYS
Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

UNIT – II
PROTECTION OF GENERATORS & TRANSFORMERS

UNIT – III
PROTECTION OF FEEDERS & LINES
UNIT – IV
CIRCUIT BREAKERS

UNIT – V
OVER VOLTAGES IN POWER SYSTEMS
Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

Course Outcomes: At the end of the course the student should be able to:

- Explain the principles of operation of various types of electromagnetic relays, Static relays as well as Microprocessor based relays
- Understanding the protection of generators and determination of what % generator winding is unprotected under fault occurrence
- Understanding the protection of transformers and make design calculations to determine the required CT ratio for transformer protection
- Explain the use of relays in protecting Feeders, lines and bus bars
- Solve numerical problems concerning the arc interruption and recovery in circuit breakers
- Understand why over voltages occur in power system and how to protect the system

TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes:
After completion of this subject the students will be able to:
1. Do programming with 8086 microprocessors
2. Understand concepts of Intel x86 series of processors
3. Program MSP 430 for designing any basic Embedded System
4. Design and implement some specific real time applications
   Using MSP 430 low power microcontroller.

UNIT I
Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register,
Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory
Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory
organization and memory banks accessing.

UNIT II
Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives-
Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code
conversion. String Manipulation instructions-Simple ALPs.

UNIT III
Low power RISC MSP430 – block diagram, features and architecture, Variants of the
MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted
applications, MSP430x5x series block diagram, Addressing modes, Instruction set
Memory address space, on-chip peripherals (analog and digital), and Register
sets. Sample embedded system on MSP430 microcontroller.

UNIT-IV
I/O ports pull up/down resistors concepts, Interrupts and interrupt programming.
Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes,
Active vs Standby current consumption, FRAM vs Flash for low power & reliability.
Timer & Real Time Clock (RTC), PWM control, timing generation and measurements.
Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer
using DMA.
UNIT-V
Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100

Text Books:

References:
Course Objectives: The objectives of the course are to make the students learn about:

- Y bus and Z bus of a Power System network
- Power flow studies by various methods.
- Short circuit analysis of power systems.
- Swing equation and its solution
- Equal area criterion and its applications

UNIT - I
POWER SYSTEM NETWORK MATRICES

UNIT – II
SHORT CIRCUIT ANALYSIS
UNIT – III
POWER FLOW STUDIES-I

UNIT – IV
POWER FLOW STUDIES-II

UNIT – V
POWER SYSTEM STABILITY ANALYSIS

Course Outcomes: At the end of the course the student should be able to:
- Form the $Z_{bus}$ and $Y_{bus}$ of a given power system network
- Compare different methods used for obtaining load flow solution
- Conduct load flow studies on a given system
- Make fault calculations for various types of faults
- Determine the transient stability by equal area criterion
- Determine steady state stability power limit
- Distinguish between different types of buses used in load flow solution
TEXT BOOKS:

REFERENCE BOOKS:
Course Objective: The objectives of the course are to make the students learn about:

- Importance of AI techniques in engineering applications
- Artificial Neural network and Biological Neural Network concepts
- ANN approach in various Electrical Engineering problems
- Fuzzy Logic and Its use in various Electrical Engineering Applications

UNIT – I
INTRODUCTION TO ARTIFICIAL INTELLIGENCE

UNIT – II
ARTIFICIAL NEURAL NETWORKS
Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories.

UNIT – III
ANN APPLICATIONS TO ELECTRICAL SYSTEMS

UNIT – IV
FUZZY LOGIC

UNIT – V
FUZZY LOGIC APPLICATIONS TO ELECTRICAL SYSTEMS
Course Outcomes: The students should acquire awareness about:

- Approaches and architectures of Artificial Intelligence
- Artificial Neural Networks terminologies and techniques
- Application of ANN to Electrical Load Forecasting problem, Control system problem
- Application of ANN to System Identification and Pattern recognition
- The development of Fuzzy Logic concept
- Use of Fuzzy Logic for motor control and AVR operation
- Use of Fuzzy Logic controller in an 18 bus bar system

Text Books:

References:
Course Objectives: The objectives of the course are to make the students learn about:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Designing of control circuits for various applications
- PLC logic and arithmetic operations

UNIT-I

UNIT-II

UNIT-III
PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

UNIT-IV
Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.
UNIT-V
Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintenance.

Course Outcomes: The student should be able to:

- Program a PLC for a given application
- Implement Ladder logic for various Industrial applications
- Design control circuits for various applications

TEXT BOOKS:


REFERENCES:
1. Programmable Logic Controllers: An Emphasis on design & application, Kelvin T. Erickson, Dogwood Valley Press, 2011.
Course Objectives:

The objectives of the course are to make the students learn about:

- The basic concepts of optimization and classification of optimization problems.
- Different classical Optimization techniques, linear programming, unconstrained and constrained nonlinear programming.
- Soft Computing methods – GA & PSO.

UNIT-I

INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUE


UNIT-II

LINEAR PROGRAMMING


UNIT-III

UNCONSTRAINED NONLINEAR PROGRAMMING

UNIT-IV
CONSTRANGED NONLINEAR PROGRAMMING
Characteristics of a Constrained Problem, Classification, Basic Approach of Penalty Function Method; Basic Approaches of Interior and Exterior Penalty Function Methods, Introduction to Convex Programming Problem

UNIT-V
SOFT COMPUTING METHODS
Evolutionary programming methods - Introduction to Genetic Algorithms (GA) – Control parameters – Number of generation, population size, selection, reproduction, crossover and mutation – Operator selection criteria – Simple mapping of objective function to fitness function – constraints – Genetic algorithm steps – Stopping criteria – Simple examples.
Swarm intelligence programming methods - Basic Partial Swarm Optimization – Method – Characteristic features of PSO procedure of the global version – Parameters of PSO (Simple PSO algorithm – Operators selection criteria – Fitness function constraints)

Course Outcomes:
The student should be able to:
- Develop an objective function and obtain solution for multivariable optimization problem with equality/Inequality constraints
- Apply linear programming techniques for problem solving
- Apply nonlinear programming techniques for unconstrained/constrained optimization
- Use soft computing techniques to solve optimization problems

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

UNIT – I

UNIT – II
Trade Marks : Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.

UNIT – III

UNIT – IV
Trade Secrets : Trade Secrete Law, Determination Of Trade Secrete Status, Liability For Misappropriations Of Trade Secrets, Protection For Submission, Trade Secrete Litigation.
Unfair Competition : Misappropriation Right Of Publicity, False Advertising.

UNIT – V
TEXT BOOKS & REFERENCES:

Course Outcomes:
On completion of this course, the student will have an understanding of the following:
   a) Intellectual Property Rights and what they mean
   b) Trade Marks and Patents and how to register them
   c) Laws Protecting the Trade Marks and Patents
   d) Copy Right and laws related to it.
Part A: 8086 Microprocessor Programs using NASM/8086 microprocessor kit.

1. Introduction to MASM Programming.
2. Programs using arithmetic and logical operations
3. Programs using string operations and Instruction prefix: Move Block, Reverse string, Sorting, String comparison
4. Programs for code conversion
5. Multiplication and Division programs
6. Sorting and multi byte arithmetic
7. Programs using CALL and RET instructions

Part B: Embedded C Experiments using MSP430 Microcontroller

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs, push buttons)
2. Usage of Low Power Modes: (Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current)
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430
8. Low Power modes and Energy trace++:
   a. Enable Energy Trace and Energy Trace ++ modes in CCS
   b. Compute Total Energy, and Estimated lifetime of an AA battery.

Note: Any six experiment from Part A and Six experiments from Part B are to be conducted
Course Objectives: The student will understand:
- The characteristics of power electronic devices with gate firing circuits
- Various forced commutation techniques
- The operation of single-phase voltage controller, converters and Inverters circuits with R and RL loads
- Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

Any Eight of the Experiments in Power Electronics Lab
1. Gate Firing Circuits for SCRs
2. Single Phase AC Voltage Controller with R and RL Loads
3. DC Jones Chopper with R and RL Loads
4. Forced Commutation Circuits (Class A, Class B, Class C, Class D and Class E)
5. Three phase fully controlled Bridge converter with R-load
7. Single phase Cycloconverter with R and RL loads
8. Single Phase Series Inverter with R and RL loads
9. Single Phase Dual Converter with RL Loads
10. Illumination control / Fan control using TRIAC

Any Four Experiments of the following (1, 2, 3, A, B, C):
1. Using TPS7A4901 and TPS7A8300, study-
   a. Impact of line and load conditions on drop out voltage
   b. Impact of line and load conditions on efficiency
   c. Impact of capacitor on PSRR
   d. Impact of output capacitor on load-transient response

2. Study of DC-DC Buck converter
   a) Investigate how the efficiency of a TPS54160 buck regulator depends on the line and load conditions and on the switching frequency.
   b) Analyze the influence of switching frequency $f_s$ and of capacitance $C$ and resistance ESR of the input and output capacitors on steady-state waveforms of TPS54160 buck regulator.
3. Analyze how the switching frequency $f_s$, the DC accuracy and the line noise rejection of the hysteretic buck regulator LM3475 depend on line voltage, the load current, the characteristics of the output capacitor and the impact of speed-up capacitor.

WEBENCH EXPERIMENTS:

A. Design of a Low cost Boost Converter to derive 12V, 100mA from 5V USB
B. Design of a low cost and power efficient Buck Converter that could be used as a USB charger for mobile devices deriving its power from an automotive battery.
C. Design of a low cost synchronous buck converter.

Course Outcomes: Student should be able to:

- Test the turn on –turn off characteristics of various power electronic devices.
- Test and analyze firing circuits for SCRs
- Test different types of voltage controllers, converters and Inverters with R and RL loads
- Analyze the TPS7A4901, TPS7A8300 and TPS54160 buck regulators

REFERENCES:

1. INTRODUCTION
With increased globalization and rapidly changing industry expectations, employers are looking for the wide cluster of skills to cater to the changing demand. The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be a laboratory course to enable students to use ‘good’ English and perform the following:
- Gathering ideas and information and to organise ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Taking part in social and professional communication.

2. OBJECTIVES:
This Lab focuses on using multi-media instruction for language development to meet the following targets:
- To improve the students’ fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:
The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:
UNIT-I: COMMUNICATION SKILLS
1. Reading Comprehension
2. Listening comprehension
3. Vocabulary Development
4. Common Errors

UNIT-II: WRITING SKILLS
1. Report writing
2. Resume Preparation
3. E-mail Writing

UNIT-III: PRESENTATION SKILLS
1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV: GETTING READY FOR JOB
1. Debates
2. Group discussions
3. Job Interviews

UNIT-V: INTERPERSONAL SKILLS
1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

4. LEARNING OUTCOMES:
   • Accomplishment of sound vocabulary and its proper use contextually
   • Flair in Writing and felicity in written expression.
   • Enhanced job prospects.
   • Effective Speaking Abilities

5. MINIMUM REQUIREMENT:
The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:
   • Spacious room with appropriate acoustics.
   • Round Tables with movable chairs
   • Audio-visual aids
   • LCD Projector
   • Public Address system
   • P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
   • T. V, a digital stereo & Camcorder
   • Headphones of High quality
6. SUGGESTED SOFTWARE:
The software consisting of the prescribed topics elaborated above should be procured and G

1. Walden Infotech: Advanced English Communication Skills Lab
2. K-VAN SOLUTIONS-Advanced English Language Communication Skills lab
3. DELTA’s key to the Next Generation TOEFL Test: Advanced Skills Practice.
4. TOEFL & GRE( KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. Train2success.com

7. BOOKS RECOMMENDED:
6. Campus to Corporate, Gangadhar Joshi, Sage Publications, 2015
Course Objectives: The student has to acquire knowledge about:

- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

UNIT – I
LOAD MODELING AND CHARACTERISTICS
Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

UNIT – II
CLASSIFICATION OF DISTRIBUTION SYSTEMS

UNIT – III
SUBSTATIONS
UNIT – IV
POWER FACTOR IMPROVEMENT
Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

UNIT – V
DISTRIBUTION AUTOMATION

Course Outcomes: Student should be able to:
- Compute the various factors associated with power distribution
- Make voltage drop calculations in given distribution networks
- Learn principles of substation maintenance
- Compute power factor improvement for a given system and load
- Understand implementation of SCADA for distribution automation

TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes:
At the end of the course, the student should be able to:
- Formulate engineering problems in terms of DSP tasks.
- Apply engineering problems solving strategies to DSP problems.
- Design and test DSP algorithms.
- Analyze digital and analog signals and systems.
- Encode information into signals.
- Design digital signal processing algorithms.
- Design and simulate digital filters.
- Analyze and compare different signal processing strategies.

UNIT-I
**Discrete Fourier Transform:** Frequency-domain sampling and reconstruction of discrete-time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT.

UNIT-II
Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2, Radix-4, and Split radix FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, 2N point real sequences, Use of the FFT algorithm in linear filtering and correlation, A linear filtering approach to computation of the DFT- the Goertzel, and the Chirp-z transform algorithms, Quantization errors in the computation of DFT.

UNIT-III
Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Frequency sampling, and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, Conversion from Lattice structure to direct form, lattice – Ladder structure.
UNIT-IV

UNIT-V
Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

TEXT BOOKS:

REFERENCES:
Course Objectives: The objectives of the course are to make the students learn about:

- Optimum generation allocation
- Hydrothermal scheduling
- Modeling of turbines and generators
- Load frequency control in single area and two area systems
- Reactive power compensation in power systems
- Power system operation in competitive environment

UNIT – I
ECONOMIC OPERATION

UNIT – II
HYDROTHERMAL SCHEDULING

UNIT – III
LOAD FREQUENCY CONTROL
UNIT – IV
REACTIVE POWER CONTROL

UNIT – V
POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT

Course Outcomes: After completion of the course, the student will able to:
- Develop the mathematical models of turbines and governors
- Address the Load Frequency Control problem
- Explain how shunt and series compensation helps in reactive power control
- Explain the issues concerned with power system operation in competitive environment

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives: The objectives of the course are to make the students learn about:
- The laws of illumination and their application for various lighting schemes
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations.

UNIT–I
ILLUMINATION

UNIT–II
ELECTRIC HEATING & WELDING

UNIT–III
ELECTRIC TRACTION – I
UNIT–IV
ELECTRIC TRACTION - II

UNIT–V
ECONOMIC ASPECTS OF UTILISING ELECTRICAL ENERGY

Course Outcomes: Student should be able to:
- Develop a lighting scheme for a given practical case.
- Analyze the performance of Heating and Welding methods
- Make all numerical calculations associated with electric traction.
- Assess the economic aspects in utilisation of electrical energy

TEXT BOOKS:

REFERENCE BOOKS:
MODERN CONTROL THEORY
(CBCC-II)

Course Objective: The objectives of the course are to make the students learn about:
- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

UNIT – I
STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION

UNIT – II
CONTROLLABILITY, OBSERVABILITY,
Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

UNIT – III
STATE FEEDBACK CONTROLLERS AND OBSERVERS
Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

UNIT – IV
ANALYSIS OF NONLINEAR SYSTEMS
Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phase-plane analysis of nonlinear control systems.
UNIT- V
STABILITY ANALYSIS
Stability in the sense of Lyapunov. Lyapunov’s stability and Lypanov’s instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems.

TEXT BOOKS:

REFERENCE BOOKS:

Course Outcomes: At the end of studying the course, the student should be able to:
- Model a given dynamic system in state space and obtain the solution for the state equation
- Test whether a given system is controllable and/or observable
- Design a state feedback controller for pole placement
- Design an observer for state estimation
- Apply Lyapunov criterion and determine stability of a given system
- Analyze nonlinear systems
Course Objectives: The objectives of the course are to make the students learn about:

- The concepts of modern power electronic converters and their applications in electric power utility.
- Analyzing and control of various power converter circuits

UNIT – I
NON-ISOLATED DC-DC CONVERTERS

UNIT – II
ISOLATED DC-DC CONVERTERS

UNIT-III
RESONANT CONVERTERS
Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-parallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

UNIT-IV
DYNAMIC ANALYSIS OF DC-DC CONVERTERS
Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.
UNIT-V

CONTROLLER DESIGN

Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and Non-Isolated DC-DC Converters.

Course Outcomes: Upon completion of this course,

- The student learns the fundamental concepts of DC-DC Converters
- Student can explain the operation of different topologies of DC to DC converters and their differences
- Student will be able to model various converters as per state space, time average etc.
- Student can analyse in frequency domain with different P, PI and PID converters

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives: The objectives of this course include
- To learn about energy consumption and situation in India
- To learn about Energy Auditing.
- To learn about Energy Measuring Instruments.
- To understand the Demand Side Management.

UNIT -I
INTRODUCTION TO ENERGY AUDITING

UNIT -II
ENERGY EFFICIENT MOTORS AND POWER FACTOR IMPROVEMENT

UNIT –III
LIGHTING AND ENERGY INSTRUMENTS FOR AUDIT
Good Lighting System Design and Practice, Lighting Control, Lighting Energy Audit - Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tong Testers, Application of PLC’s

UNIT –IV
INTRODUCTION TO DEMAND SIDE MANAGEMENT
UNIT –V
ECONOMICS AND COST EFFECTIVENESS TESTS OF DSM PROGRAMS
Basic payback calculations, Depreciation, Net present value calculations. Taxes and Tax Credit – Numerical Problems. Importance of evaluation, measurement and verification of demand side management programs. Cost effectiveness test for demand side management programs - Ratepayer Impact Measure Test, Total Resource Cost, Participant Cost Test, Program Administrator Cost Test
Numerical problems: Participant cost test, Total Resource Cost test and Ratepayer impact measure test.

Course Outcomes: After completion of the course the student should be able to:
- Conduct energy auditing and evaluate energy audit results
- Carry out motor energy audit
- Analyze demand side management concepts through case study

TEXT BOOKS:

REFERENCES:
Course Objectives: The objectives of the course are to make the students learn about:
- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering, and protocols for smart metering
- Management systems for Transmission and distribution

UNIT – I
THE SMART GRID

UNIT – II
COMMUNICATION TECHNOLOGIES


UNIT – III
INFORMATION SECURITY FOR THE SMART GRID
Introduction, Encryption and Decryption, Symmetric Key Encryption, Public Key Encryption, Authentication, Authentication Based on Shared Secret Key, Authentication Based on Key Distribution Center, Digital Signatures, Secret Key Signature, Public Key Signature, Message Digest, Cyber Security Standards, IEEE 1686: IEEE Standard for
UNIT – IV
SMART METERING AND DEMAND SIDE INTEGRATION
Introduction, smart metering – evolution of electricity metering, key components of smart metering, smart meters: an overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output, communication.
Communication infrastructure and protocols for smart metering- Home area network, Neighbourhood Area Network, Data Concentrator, meter data management system, Protocols for communication. Demand Side Integration- Services Provided by DSI, Implementation of DSI, Hardware Support, Flexibility Delivered by Prosumers from the Demand Side, System Support from DSI.

UNIT – V
TRANSMISSION AND DISTRIBUTION MANAGEMENT SYSTEMS

Course Outcomes: The student should have learnt about:
- How to meet the standards for information exchange and for smart metering
- How to preserve data and Communication security by adopting encryption and decryption procedures.
- Monitoring, operating, and managing the transmission and distribution tasks under smart grid environment

TEXT BOOKS:
REFERENCES:

Course Objectives: The objectives of the course are to make the students learn about:

- The basic concepts, different types, and applications of FACTS controllers in power transmission.
- The basic concepts of static shunt and series converters
- The working principle, structure and control of UPFC.

UNIT-I

CONCEPTS OF FLEXIBLE AC TRANSMISSION SYSTEMS

Transmission line Interconnections, Power flow in parallel lines, Mesh systems, Stability considerations, Relative importance of controllable parameters, Basic types of FACTS controllers, Shunt controllers, Series controllers, Combined shunt and series controllers, Benefits of FACTS.

UNIT-II

VOLTAGE AND CURRENT SOURCED CONVERTERS

Concept of Voltage Sourced Converters, Single Phase Full Wave Bridge Converter, Three Phase Full Wave Bridge Converter, Transformer Connections for 12-Pulse Operation, 24 and 48-Pulse Operation, Three Level Voltage Sourced Converter, Pulse Width Modulation (PWM) Converter, Converter Rating, Concept of Current Sourced Converters, Thyristor based converters, Current Sourced Converter with Turn off Devices, Current Sourced –vs- Voltage Sourced Converters.

UNIT-III

STATIC SHUNT COMPENSATORS

Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line Voltage Support to Prevent Voltage Instability, Improvement of Transient Stability, Power Oscillation Damping, Methods of Controllable VAR Generation, Variable Impedance Type Static VAR Generators, Switching Converter Type VAR Generators, Hybrid VAR Generators, SVC and STATCOM, Transient Stability Enhancement and Power Oscillation Damping, Comparison Between STATCOM and SVC, V-I, V-Q Characteristics, Response Time.
UNIT-IV
STATIC SERIES COMPENSATORS
Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Subsynchronous Oscillation Damping, Variable Impedance Type Series Compensators, GTO Thyristor Controlled Type Series Capacitor (GCSC), Thyristor Switched Series Capacitor (TSSC), Thyristor-Controlled Series Capacitor (TCSC), Basic Operating Control Schemes for GCSC, TSSC, and TCSC, Switching Converter Type Series Compensators, The Static Synchronous Series Capacitor (SSSC), Transmitted Power Versus Transmission Angle Characteristic, Control Range and VA Rating, Capability to Provide Real Power Compensation.

UNIT-V
POWER FLOW CONTROLLERS

Course Outcomes: After completing this course the student will be able to:
- Understand various control issues, for the purpose of identifying the scope and for selection of specific FACTS controllers.
- Apply the concepts in solving problems of simple power systems with FACTS controllers.
- Design simple FACTS controllers and converters for better transmission of electric power.

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives: The objectives of the course are to make the students learn about:
- Power quality issues and standards.
- The sources of power quality disturbances and power transients that occur in power systems.
- The sources of harmonics, harmonic indices, Devices for controlling harmonic distortion.
- The principle of operation of DVR and UPQC.

UNIT I
INTRODUCTION

UNIT II
TRANSIENTS, SHORT DURATION AND LONG DURATION VARIATIONS

UNIT III
FUNDAMENTALS OF HARMONICS & APPLIED HARMONICS

UNIT-IV
POWER QUALITY MONITORING
of Instruments- Assessment of Power Quality Measurement Data- Power Quality Monitoring Standards.

UNIT V
POWER QUALITY ENHANCEMENT USING CUSTOM POWER DEVICES

Course Outcomes: After completion of the course the student should be able to:

- Address power quality issues to ensure meeting of standards
- Apply the concepts of compensation for sags and swells using voltage regulating devices
- Assess harmonic distortion and its mitigation.
- Explain the power measurement data according to standards

TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes:
- Able to design real time DSP systems and real world applications.
- Able to implement DSP algorithms using both fixed and floating point processors.

List of Experiments: (Minimum of 5 experiments are to be conducted from each part) Software Experiments (PART – A)
1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.

Using DSP Processor kits (Floating point) and Code Composure Studio (CCS) (PART – B)
1. Generation of random signal and plot the same as a waveform showing all the specifications.
2. Finding Power and (or) Energy of a given signal.
3. Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations.
4. DTFT of a given signal
5. N – point FFT algorithm
6. Design of FIR filter using windowing technique and verify the frequency response of the filter.
7. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
8. Design of analog filters.
Equipment/Software Required:
1. Licensed MATLAB software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composure Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies.
Course Objectives: The objectives of this course include:

- Experimental determination (in machines lab) of sequence impedance and subtransient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.

List of Experiments:

2. Fault Analysis – I
   LG Fault
   LL Fault
3. Fault Analysis – II
   LLG Fault
   LLLG Fault
4. Determination of Subtransient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer.
6. $Y_{bus}$ formation using MATLAB
7. $Z_{bus}$ formation using MATLAB
8. Gauss-Seidel load flow analysis using MATLAB
9. Fast decoupled load flow analysis using MATLAB
10. Develop a Simulink model for a single area load frequency control problem
Course Outcomes:
At the end of the lab course, the student should be able to do the following:

- Experimental determination (in machines lab) of sequence impedance and subtransient reactances of synchronous machine
- Conducting experiments to analyze LG, LL, LLG, LLLG faults
- The equivalent circuit of three winding transformer by conducting a suitable experiment.
- Developing MATLAB program for formation of Y and Z buses.
- Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
- Developing the SIMULINK model for single area load frequency control problem.
Course Objectives: The objectives of the course are to make the students learn about:

- Common errors that occur in measurement systems, and their classification
- Characteristics of signals, their representation, and signal modulation techniques
- Methods of Data transmission, telemetry, and Data acquisition.
- Working principles of different signal analyzers and Digital meters.
- Several types of transducers and their use for measurement of non-electrical quantities.

UNIT-I

CHARACTERISTICS OF SIGNALS AND THEIR REPRESENTATION


UNIT-II

DATA TRANSMISSION, TELEMETRY AND DAS


UNIT-III

SIGNAL ANALYZERS, DIGITAL METERS

Wave Analysers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters, Digital Voltmeters - Successive Approximation, Ramp and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer
UNIT-IV
TRANSCLUDERS
Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezoelectric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

UNIT-V
MEASUREMENT OF NON-ELECTRICAL QUANTITIES

Course Outcomes:
The student should be able to:
- Identify and explain the types of errors occurring in measurement systems
- Differentiate among the types of data transmission and modulation techniques
- Apply digital techniques to measure voltage, frequency and speed
- Choose suitable transducers for the measurement of non-electrical quantities

TEXT BOOKS:

REFERENCE BOOKS:
Course Objectives: The objectives of the course are to make the students learn about:

- The kinds of power stability problems
- The basic concepts of modelling and analysis of dynamical systems.
- Modelling of power system components - generators, transmission lines, excitation and prime mover controllers.
- Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.
- The impact of stability problems on power system planning and operation.

Unit – I Introduction to Power System Stability

Unit – II Modelling of a Synchronous Machine

Unit – III Modelling of power system components

Unit – IV Stability Issues in Interconnected Power Systems
Unit – V Enhancing System Stability

Course Outcomes: After completion of Course, the student should be able to

- Understand the power stability problems
- Understand the basic concepts of modelling of synchronous machine and power system components
- Analyse the stability issues in interconnected systems
- Understand the power system stability analysis tools and enhancement of power system stability

Reference Books:
Course Objectives: The objectives of the course are to make the students learn about

- Sensors and types of measurement systems
- Process control and sequence control of different controllers
- Operation of actuators
- Types of electric drives and their principles

Unit – I Introduction to sensors and measurement systems

Unit – II Introduction to Process Control
P-- I -- D Control - Controller Tuning - Implementation of PID Controllers - Special Control Structures: Feed forward and Ratio Control - Special Control Structures: Predictive Control, Control of Systems with Inverse Response - Special Control Structures: Cascade Control, Overriding Control, Selective Control, Split Range Control.

Unit – III Introduction to Sequence Control
PLCs and Relay Ladder Logic - Sequence Control: Scan Cycle, RLL Syntax - Sequence Control: Structured Design Approach - Sequence Control: Advanced RLL Programming - Sequence Control: The Hardware environment

Unit – IV Introduction to Actuators
Unit – V Electric Drives

Course Outcomes: After completion of Course, the student should be able to
- Understand the measurement of different quantities
- Apply principles of electric drives for different applications like speed control
- Understand the principles of process control and sequence control in relay ladder logic.
- Understand the operation of controller in integrated control systems

Reference Books:
3. David W. Pessen, Industrial Automation: Circuit Design and Components
4. Wiley India Publication, 2011
Course Objectives: The objectives of the course are to make the students learn about:
- Technical and economic aspects of HVAC and HVDC transmission and their comparison.
- Static power converters
- Control of HVDC converter systems
- Origin, effects, classification and elimination of harmonics
- The occurrence of faults, and transients in HVDC system and their protection.

UNIT-I
INTRODUCTION TO HVDC TRANSMISSION

UNIT-II
STATIC POWER CONVERTER ANALYSIS
Static Power Converters: 3-Pulse, 6-Pulse & 12-Pulse Converters, Converter Station and Terminal Equipment, Commutation Process, Rectifier and Inverter Operation, Equivalent Circuit for Rectifier, Inverter and HVDC Link- Special Features of Converters.

UNIT-III
CONTROL OF HVDC CONVERTER SYSTEMS
Control of HVDC Converter Systems: Principle of DC Link Control – Constant Current, Constant Extinction Angle and Constant Ignition Angle Control and Voltage Dependent Current Control. Individual Phase Control and Equidistant Firing Angle Control

UNIT-IV
HARMONICS AND FILTERS
UNIT-V
TRANSIENTS, FAULTS AND PROTECTION OF HVDC SYSTEMS

Course Outcomes: After Completion of Course, the student should be able to:
- Compare HVDC and HVAC transmission systems
- Understand the operation of various converters used in HVDC transmission systems
- Devise means to suppress / eliminate harmonics.
- Design HVDC and AC Filters

TEXT BOOKS:

REFERENCES:
Course Outcomes:

After completion the students will be able to

- Design of embedded systems leading to 32-bit application development.
- Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking and IoT concepts based upon connected MCUs

UNIT-I
Introduction to Embedded Systems
Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT-II
Embedded processor architecture
CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT- III
Overview of Microcontroller and Embedded Systems
Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices.

UNIT-IV
Microcontroller fundamentals for basic programming
I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

Unit-V
Embedded communications protocols and Internet of things
Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub BoosterPack” Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API. Case Study: Tiva based Embedded Networking Application: “Smart Plug with Remote Disconnect and Wi-Fi Connectivity”

Text Books:
4. 0070667640, 9780070667648
References:

Course Objectives: The objectives of the course are to make the students learn about:

- Production of quality of energy
- Types of generation plants and their principle of operation
- Methods of energy storage
- Economics of generation

Unit – I: Fundamentals principles of energy

Unit – II: Thermal, Hydro and Nuclear power sources

Unit – III: Solar, wind and photo voltaic power sources

Unit – IV: Other sources of energy

Unit – V: Energy storage and Economy

Course Outcomes: After completion of Course, the student should be able to:
- Understand different types of sources of energy
- Analyse the generation principles and operation of variety of sources of energy
- Understand energy storage and economy
Reference Books: