# Program Structure and Syllabus of

# B. Tech III-Year (I & II Semesters)

# Electrical & Electronics Engineering

## R-20 Regulations

ANURAG UNIVERSITY

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**III YEAR I SEMESTER** **COURSE STRUCTURE**

| S.No | Course Code | Category | Course | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | A55005 | PCC | Power Systems-II | 2 | 0 | 0 | 2 |
| 2 | A55006 | PCC | Power Electronics | 3 | 0 | 0 | 3 |
| 3 | A55007 | PCC | Electrical Machines –III | 3 | 0 | 0 | 3 |
| 4 | A55008 | PCC | Integrated Circuits & Applications | 2 | 0 | 0 | 2 |
| 5 | A55009<br>A55010<br>A55011 | PEC-I | Renewable Energy Technology<br>Electrical Machine Design<br>Control System Design | 3 | 0 | 0 | 3 |
| 6 | A55093<br>A55012<br>A55092 | OE-I | Industrial Safety and Hazard Management<br>Disaster Preparedness and Planning<br>Introduction to Artificial Intelligence and Machine Learning | 3 | 0 | 0 | 3 |
| 7 | A55203 | PCC | Electrical Machines Lab -II | - | 0 | 3 | 1.5 |
| 8 | A55241 | HSMC | Skills Integrated Language Lab | - | 0 | 2 | 1.0 |
| 9 | A55288 | BSC LAB | Quantitative Aptitude and Reasoning | 0 | 0 | 3 | 1.5 |
| 10 | A55091 | MC | NSS and NSO | 2 | 0 | - | 0 |
| **TOTAL** | | | | **19** | **00** | **05** | **20** |

**III YEAR II SEMESTER** **COURSE STRUCTURE**

| S.No | Course Code | Category | Course | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | A56012 | PCC | Switch Gear & Protection | 3 | 0 | 0 | 3 |
| 2 | A56013 | PCC | Power System Operation & Control | 3 | 0 | 0 | 3 |
| 3 | A56014 | PCC | Micro Processor & Micro Controllers | 3 | 0 | 0 | 3 |
| 4 | A56015 | PCC | Electrical Measurements & Instrumentation | 3 | 0 | 0 | 3 |
| 5 | A56016<br>A56017<br>A56018 | PEC-II | Signals & Systems<br>Advanced Power Electronics Converters<br>Industrial Electrical Systems | 3 | 0 | 0 | 3 |
| 6 | A56080 | ESC | Data Base Management Systems | 2 | 0 | 0 | 2 |
| 7 | A56203 | PCC | Power Electronics & Simulation Lab | 0 | 0 | 3 | 1.5 |
| 8 | A56204 | PCC | Measurements and Instrumentation Lab | 0 | 0 | 3 | 1.5 |
| **TOTAL** | | | | **17** | **00** | **06** | **20** |

## Power Systems-II

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55005** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 2 | 0 | 0 | 2 | 40 | 60 | 100 |

### Course Objectives:

Course Objectives of PS-II are to:

1. To gain knowledge on the basic transmission line parameters.
2. To classify & study the performance of short, medium & long transmission lines.
3. To gain knowledge on various factors governing the performance of transmission line
4. To understand overhead line insulators
5. To perform sag calculations and study underground cables.

### Course Outcomes:

At the end of this PS-II course, students will be able to

1. Determine the line parameters of Transmission lines.
2. Analyze the Performance of short, Medium, long Transmission lines.
3. Assess various factors governing the performance of Transmission Lines.
4. Understand the various types of overhead line insulators.
5. Perform sag and tension calculations for various transmissions and also describe the features of Under Ground Cables.

### Unit- I:

**Transmission Line Parameters**

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems.

Calculation of capacitance for single phase two wire system, effect of ground on capacitance, Capacitance calculations for symmetrical and asymmetrical - three phase and double circuit lines, Numerical Problems.

### Unit- II:

**Performance of Short, Medium and Long TransmissionLines**

Classification of Transmission Lines - Short, medium and long lines and their model representations - Nominal-T, Nominal-Pie and ABCD Constants for symmetrical & Asymmetrical Networks,

Numerical Problems, voltage regulation and efficiency of all types of lines - Numerical Problems. Long Transmission Line-Rigorous Solution, evaluation of ABCD Constants, Surge Impedance and SIL of Long Lines

**Unit- III:**

**Factors Governing the Performance of Transmission line**

Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line, Shunt Compensation. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

**Unit- IV:**

**Overhead Line Insulators**

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.

**Unit- V:**

**Sag and Tension Calculations and Underground Cables**

Sag and Tension Calculations with equal and unequal heights of towers Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template.

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in cables, Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

**Text Books:**


1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Principles of Power Systems - V.K Mehta and Rohit Mehta, S.Chand Company Ltd., New Delhi 2004


**References Books:**


1. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited Publishers, 1998.
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition.

# Power Electronics

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55006** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of PE are to:

1. To learn the basic concepts of power electronic devices and their characteristics
2. To understand the various triggering & commutation methods for SCRs
3. To study the principle of operation of single phase and three phase line commutated converters
4. To understand the principle of operation of AC Voltage controllers and Cyclo converters
5. To study the principle of operation of various types of Choppers and Inverters.

## Course Outcomes:

At the end of this PE course, students will be able to

1. Evaluate the characteristics of various Power Electronics devices such as SCR, MOSFET, IGBT and TRIAC
2. Analyze different types of Trigerring and commutation techniques for SCR
3. Use concepts of Power Electronic devices in Single Phase and three phase controlled rectifiers for speed control of DC Motor
4. Analyze the operation of AC voltage controllers, Cyclo Converters with different loads
5. Use Inverters, Choppers for speed control of AC and DC Motors.

## Unit-I:

**Power Semi Conductor Devices and Commutation Circuits**

Thyristors – Silicon Controlled Rectifiers (SCRs) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors .Basic theory of operation of SCR – Static characteristics and Dynamic characteristics of SCR - Turn on and Turn off times – Turn on and turn off methods- Salient points. Types of Power Supplies.

Two transistor analogy of SCR - UJT firing circuit - Series and parallel connections of SCRs Snubber circuit details – Specifications and Ratings of SCRs, BJT, IGBT - Numerical problems.

## Unit-II:

### Single Phase Half Controlled and Fully Controlled Converters

Phase control technique - Single phase Line commutated converters Midpoint and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load with continuous current mode of operation –Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Freewheeling Diode.

Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load for continuous current mode of operation. Derivation of average load voltage and current – Line commutated inverters. Active and Reactive power inputs to the converters without and with Freewheeling Diode. Effect of source inductance – Derivation of load voltage and current – Numerical problems.

## Unit-III:

### Three Phase Line Commutated Converters

Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage With R and RL loads.

Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms – Numerical Problems.

## Unit-IV:

### AC Voltage controllers & Cyclo converters

AC voltage controllers – Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms. Firing circuits -Numerical problems.

Cyclo converters – Single phase midpoint Cyclo converters with Resistive and inductive loads (Principle of operation only) – Bridge configuration of single phase Cyclo converter (Principle of operation only) – Waveforms

## Unit-V:

### Choppers and Inverters

Choppers – Time ratio control and Current limit control strategies – Buck choppers Derivation of load voltage and currents with R, RL and RLE loads for continuous and discontinuous current modes. Boost Chopper – load voltage expression. Morgan's chopper – Jones chopper (Principle of operation only) -Waveforms - AC Chopper – Problems.

Inverters – Single phase inverter – Basic series inverter – Basic parallel Capacitor inverter- Bridge inverters -120$^{o}$ and 180$^{o}$ modes of operation – Waveforms – Simple forced commutation circuits for bridge inverters. Voltage control techniques for inverters-Pulse width modulation techniques – Numerical problems.

**Text Books:**

1. Power Electronics-P.S. Bimbhra- Khanna Publishers, 4th Edition
2. Power Electronics – M.D. Singh & K.B. Kanchandhani, Tata Mc Graw – Hill Publishing Company, 2nd edition.

**Reference Books:**

1. Power Electronics: Circuits Devices and Applications – M.H. Rashid, Prentice Hall of India, and 3rd edition.
2. Thyristorised Power Controllers – G.K. Dubey, S.R Doradra, A. Joshi and R.M.K. Sinha, New Age international Pvt Ltd. Publishers latest edition.
3. Power Electronics – P.C. Sen, Tata Mc Graw-Hill Publishing

# Electrical Machines- III

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55007** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course objectives:

Course Objectives of EM-III are to:

1. To understand principle of operation & characteristics of synchronous Generators
2. To gain knowledge of various methods to determine voltage regulation of synchronous generators
3. To understand parallel operation of synchronous Generators
4. To study the principle of operation of Synchronous motors
5. To learn the principle of Operation & applications of special motors.

## Course Outcomes:

At the end of this EM-III course, students will be able to

1. Explain the principle of operation of Synchronous motors.
2. Describe different methods of voltage regulation and parallel operation of Synchronous Generators.
3. Operate synchronous generators in parallel.
4. Describe the constructional details and principle of operation of Synchronous motors.
5. Explain the operation of special motors and their applications in daily life.

## Unit-I:

**Construction-Principle of Operation& Characteristics of Synchronous Generator**

Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated e.m.f. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics.

## Unit-II:

**Voltage Regulation of Synchronous Generators**

Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – Salient pole alternators – two reaction theory – experimental determination of $X_d$ and $X_q$ (Slip test) Phasor diagrams – Regulation of salient pole alternators. Numerical Problems.

## Unit-III:

**Parallel Operation of Synchronous Generators**

Synchronizing alternators with infinite bus bars – Synchronizing power and synchronizing torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance's. Numerical Problems.

## Unit-IV:

**Synchronous Motors**

Principle of operation-methods of starting-phasor diagram-Variation of current and power factor with excitation-synchronous condenser-Mathematical analysis for power developed-circle diagrams of synchronous machines-hunting and its suppression-damper windings. Numerical Problems.

## Unit-V:

**Special Motors**

Basic Principle of operation and application of AC series motor-Universal motor-Stepper motor – shaded pole motor-Reluctance motor-BLDC motor (Elementary treatment only). Applications of Fractional Watt Motors.

## Text Books:


1. Theory and performance of Electrical Machines- JB Gupta, SK kataria and sons, 14th Edition
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.


## References Books:


1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

# Integrated Circuit Applications

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| | | L | T | P | C | CIE | SEE | Total |
| **A55008** | PCC | 2 | 0 | 0 | 2 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of ICA are to:

1. To introduced the basic building blocks of linear integrated circuits.
2. To understand the linear and non – linear applications of operational amplifiers.
3. To introduce the concepts of waveform generation and introduce some special function ICs.
4. To understand the theory and applications of PLL, and design ADC and DAC.
5. To understand and implement the working of basic digital circuits

## Course Outcomes:

At the end of this ICA course, students will be able to

1. Design various applications of Op-Amps.
2. Design the circuits using special ICs like 555 timer, 723 voltage regulator and 565 PLL.
3. Design A/D and D/A Converters using ICs.
4. Design digital circuits using digital ICs.
5. Design different families of digital integrated circuits and their characteristics.

## UNIT I:

**Integrated Circuits**

Introduction: Classification. Chip Size and Circuit Complexity, Ideal and Practical Op-Amp, Op-amp characteristics-DC and AC Characteristics. 741 Op-Amp and its Features, Modes of operation-inverting, non-inverting, differential.
Applications: Basic Applications of Op-Amp, Instrumentation Amplifier, V to I and I to V Converters, Sample & Hold Circuits, Differentiators and Integrators, Comparators. Introduction to Voltage Regulators.

## UNIT II:

**Active Filters & Oscillators**

Active Filters: First Order and Second Order Low Pass, High Pass and Band Pass Filters. Active Band Reject and All Pass Filters.

Oscillators: Principle of Operation and Types of Oscillators – RC, Wien Bridge and quadrature type. Waveform Generators – Triangular, Saw Tooth, Square Wave.

**UNIT III:**

**555 Timer & PLL**

Introduction to 555 Timer: Functional Diagram, Monostable and Astable Operations and Applications, Schmitt Trigger.

PLL: Introduction, Block Schematic, Principles and Description of individual Blocks of 565, VCO.

**UNIT IV:**

**D-A & A- D Converters**

Introduction, Basic DAC Techniques - Weighted Resistor Type, R-2R Ladder Type, Inverted R-2R Type. Different types of ADCs - Parallel Comparator Type, Counter Type, Successive Approximation Register Type and Dual Slope Type, DAC/ADC Specifications.

**UNIT V:**

**Digital Integrated Circuits Introduction**

Classification of Integrated Circuits, Standard TTL NAND Gate-Analysis & Characteristics, TTL Open Collector Outputs, Tristate TTL, MOS & CMOS Open Drain and Tristate outputs, Comparison of Various Logic Families. IC interfacing- TTL driving CMOS & CMOS driving TTL.

Combinational Circuit ICs: Use of TTL-74XX Series- Multiplexer, Demultiplexer, Encoder Sequential Circuit ICs: Commonly Available 74XX-J K Flip flop, D-Flip flop, Decade Counter.

**Text Books**:


1. Linear Integrated Circuits -D. Roy Choudhury, New Age International (p)Ltd, 3" Ed., 2008.
2. Digital Fundamentals - Floyd and Jain, Pearson Education,8th Edition, 2005.
3. Op-Amps and Linear Integrated Circuits - Concepts and Applications by James M.Fiore, Cengage/ Jaicc, 2/e, 2009.


**Reference books**:


1. Modern Digital Electronics - RP Jain - 4/e - TMH, 2010.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.

# Renewable Energy Technology

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55009** | PEC-I | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of RET are to:

1. To learn about photovoltaic energy conversion & its basics.
2. To understand solar panels such as flat plate collectors, dish collectors and converter systems.
3. To learn Renewable energy sources, like Wind Energy & Bio-Mass.
4. To understand about geothermal, ocean, tidal and wave energy & concepts of DEC.
5. To learn about various converter topologies for Wind Power Generation.

## Course Outcomes:

At the end of this RET course, students will be able to

1. Describe Renewable energy sources, generating systems, its performance characteristics and potential in India
2. Explain about solar photovoltaic energy conversion systems.
3. Analyze the Non-conventional energy sources like Wind Energy & Bio Mass.
4. Illustrate the types of energy generating systems, construction, principle, operation and applications.
5. Demonstrate the different topologies of wind energy conversion system.

## Unit – I:

**Solar Radiation and Solar Energy Collection**

**Principles of Solar Radiation**: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

## Unit – II:

**Solar photovoltaic**

Photovoltaic energy conversion, Technologies-Amorphous, monocrystalline, polycrystalline; V-I & PV characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems,

Maximum Power Point Tracking (MPPT) algorithms- Peturb and observe algorithm and incremental conductance algorithm, Converter Control.

**Solar Energy Collection**: Flat plate and concentrating collectors, classification of concentrating collectors, orientation, advanced collectors.

**Unit-III:**

**Wind Energy and Bio-Mass**

**Wind Energy**: Sources and potentials, horizontal and vertical axis windmills, tip speed ratio, stall & Pitch Control, performance characteristics, Betz criteria.

**Bio-Mass:** Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

**Unit-IV:**

**Geothermal, Ocean, Tidal and Wave Energy**

**Geothermal Energy:** Methods of harnessing the energy.

**Ocean Energy:** OTEC, Principles utilization, setting of OTEC plants.

**Tidal and Wave energy:** Potential and conversion techniques.

**Direct Energy Conversion:** Need for DEC, Carnot cycle, limitations and principles of DEC. Seebeck effect, MHD generators (Ideal and Practical).

**Unit-V:**

**Wind Generator Topologies**

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

**Text Books:**


1. Non-Conventional Energy Sources - G.D. Rai, Khanna Publishing House, 2011.
2. Doubly fed induction machine: modeling and control for wind energy generation - Abad, Gonzalo, Jesus Lopez, Miguel Rodriguez, Luis Marroyo, and Grzegorz Iwanski, John Wiley & Sons, 2011.


**Reference Books:**


1. Non-Conventional Energy Systems - K Mittal, Wheeler Publishing Co.
2. Renewable energy resources- Tiwari and Ghosal, NarosaPublishing House, 2007.
3. Non-Conventional Energy - Ashok V Desai, Wiley Eastern Ltd, New Delhi, 2003.

# Electrical Machine Design

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| | | L | T | P | C | CIE | SEE | Total |
| **A55010** | PEC-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of EMD are to:

1. To know the fundamental requirements for designing various electrical machines like transformers, IMS and Synchronous Motors
2. To expose the student the basic requirements for designing the transformers using dimensions rating space factors, cooling methods etc.
3. To study and acquire basic concepts necessary for design the induction motors
4. To provide the knowledge required for designing the various parts of synchronous machines and the winding details suitable for various ratings
5. To learn the need of CAD analysis design optimization methods FEM based design and complex structures of PMSM, BLDC and SRMS

## Course Outcomes:

At the end of this EMD course, students will be able to

1. Explain the concepts for design of various machines.
2. Analyze the designing of transformers of different ratings.
3. Design the induction motors of various ratings.
4. Design the synchronous machines with various ratings and specifications.
5. Apply the concepts and knowledge of CSD, FEM based machines design for various applications and also able to use PMSM, BLDC, SRM for various applications.

## Unit- I:

**Introduction**

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

## Unit- II:

**Transformers**

Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

## Unit- III:

**Induction Motors**

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor,

magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

**Unit- IV:**

**Synchronous Machines**

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

**Unit- V:**

**Computer aided Design (CAD):**

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

**Text Books:**


1. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory, Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.


**References Books:**


1. K. L. Narang, "A Text Book of Electrical Engineering Drawings", Satya Prakashan, 1969.
2. A.Shanmugasundaram, G. Gangadharan and R. Palani, "Electrical Machine Design Data Book", New Age International, 1979.
3. K. M. V. Murthy, "Computer Aided Design of Electrical Machines", B.S. Publications, 2008.
4. Electrical machines and equipment design exercise examples using Ansoft's Maxwell 2D machine design package.

# Control Systems Design

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55011** | PEC-I | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of CSD are to:

1. To expose the student to design specifications and its physical relevance
2. To provide the students with basic knowledge to design the classical control System in the time domain
3. To learn the design of the classical control system in the frequency domain
4. To introduce the design of PID controllers and control system design in state space representation
5. To learn to design control systems in state space and also understand the effect of non linear parameters on system performance.

## Course Outcomes:

At the end of this CSD course, students will be able to

1. Explain the various design specifications and design problems in classical control systems
2. Design of classical control system in the time domain such as Lag, Lead, lag-Lead compensator
3. Design of classical control systems in frequency domain such as Feedback and Feed forward compensator design using Bode Diagram
4. Design and analysis of PID controllers in time and frequency domain in different order systems
5. Analyze the non linearties and its effects on systems performance.

## Unit- I:

**Design Specifications**

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

## Unit- II:

**Design of Classical Control System in the time domain**

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

## Unit- III:

**Design of Classical Control System in frequency domain**

Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

## Unit- IV:

**Design of PID Controllers**

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

## Unit- V:

**Control System Design in State Space**

Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

**Nonlinearities and its effect on system performance**

Various types of non-linearties. Effect of various non-linearties on system performance. Singular points. Phase plot analysis.

## Text Books:


1. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.


## Reference Books:


1. B. C. Kuo, "Automatic Control system", Prentice Hall, 1995
2. N. Nise, "Control system Engineering", John Wiley, 2000.
3. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.

# Industrial Safety and Hazard Management

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| A55093 | OE-I | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

**Prerequisite:** Environmental Science

## COURSE OBJECTIVES:

This course will provide

- Effective use of chemical industry utilities.
- Emphasis on the knowledge of loss prevention
- A knowledge about personal safety and industrial safety.
- To determine the hazard analysis and the toxicology.
- An importance of Personal proactive equipment's used in industries

## COURSE OUTCOMES:

**The students will be able to**

- Understand the Safety principles and toxicology
- Identify and evaluate the different types of Hazard analysis.
- Analyse and take preventive measure of Fire & explosions industrial hazards and accidents.
- Apply the relief system for different types of valves in industries and statistical analysis of accidents.
- Acquire knowledge of accident investigation and Personal Protective Equipments.

## UNIT I

**Introduction:**

Safety program, Engineering ethics, Accident and loss statistics, Acceptable risk, Public perception, Toxicology: How toxicants enter biological organisms, how toxicants are eliminated from biological organisms.

## UNIT II

**Industrial Hygiene:**

Government regulations, Identification: material safety data sheets, Evaluation: evaluating exposures to volatile, Control: respirators, ventilation.

## UNIT III

**Fires and Explosions:**

The fire triangle, Distinction between fire and explosions: Definitions, Flammability characteristics of liquids and vapors, MOC and inerting, ignition energy, Auto ignition, Auto oxidation, adiabatic compression, Explosions.

**Designs to prevent fires and Explosions:**
Inerting, Explosion proof equipment and instruments, Ventilations, Sprinkler systems. Hazards Identification: Process hazards checklists, Hazard surveys, and Hazop safety reviews.

## UNIT IV

**Introduction to Reliefs**: Relief concepts: Definitions, Location of reliefs, Relief types, Data for sizing reliefs, Relief systems. **Relief Sizing**: Conventional spring operated reliefs in liquids, Conventional spring operated relief's in vapor or gas service, Rupture disc relief's in liquid, vapor or gas service.

## UNIT V

**Chemical Process Safety:** Introduction, Chemical process in Hazardous operations, chemical reactors, Reaction Hazards, Operational Deviations and Technical Report.

**Personal Protective Equipment:** Introduction, Legal Requirements, Selection guide lines, Head Protection, Eye and Face Protection, Hand Protection, Foot and Leg Protection, Body Protection, Indian standards on Personal Protective Equipment.

## TEXT BOOKS:


1. Chemical Process Safety – (Fundamentals with applications), D.A.Crowl&J.F.Louvar Prentice Hall, New Jersey, 1990.
2. Industrial Hygiene and Chemical safety –M.H.Faulekar, I.K. International, 2006.


## REFERENCES:


1. Safety and Accident Prevention in Chemical Operations, H.H.Fawcett and W.S.Wood, 2nd Edition, John Wiley and sons, New York, 1982.
2. Coulson and Richardson's – Chemical engineering – R.K.Sinnot, Vol.6, Butterworth-Heinmann Limited, 1996.

# Disaster Preparedness and Planning

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55012** | OE-I | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course objectives:

Course Objectives of Disaster Preparedness & Planning are to:

1. To know the concept, definition and terminology of the Disaster Management.
2. To know the classification and occurrence of disasters in India and elsewhere.
3. To know and analyse the socio-economic, environmental aspects of disasters impacts.
4. To know the pre, post and emergency management mitigation strategies.
5. To know the environment of vulnerable disaster areas

## Course Outcome:

At the end of this Disaster Preparedness & Planning course, students will be able to

1. To acquire knowledge of disaster Management.
2. To acquaint with different disasters in India and other parts of the world.
3. To classify, assess the magnitude and intensity of various impacts of disasters.
4. To learn the management methods.
5. Learn effective sustainable environmental modification techniques.

## UNIT-I

**Introduction:** Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

## UNIT-II

**Disasters:** Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

## UNIT-III

**Disaster Impacts:**

Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

## UNIT-IV

**Disaster Risk Reduction (DRR):**

Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster, Management Authority.

## UNIT-V

**Disasters, Environment and Development**

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

## Text books


1. H.K. Gupta,Disaster Management - - University Press, India, 2003.
2. Singh B.K, Handbook of Disaster Management: techniques and Guidelines -., Rajat, Publications, 2008


## References Books


1. Pardeep Sahni, Disaster Mitigation: Experiences and Reflections -
2. Pradeep Sahni, Disaster Risk Reduction in South Asia, Prentice Hall, 2004.


## NPTEL

1. https://nptel.ac.in/courses/105104183/

# Introduction to Artificial Intelligence and Machine Learning

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55092** | OE-I | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of Introduction to Artificial Intelligence and Machine Learningare to:

1. To familiarize with the concepts of Artificial Intelligence
2. To understand the challenges, applications and models of Machine Learning
3. To apply and evaluate supervised machine learning algorithms for classification and regression tasks
4. To apply and evaluate unsupervised learning algorithms for clustering tasks
5. To understand the Ensemble learning, apply and evaluate different type of these algorithms for better prediction.

## Course Outcomes:

At the end of this Introduction to Artificial Intelligence and Machine Learningcourse, students will be able to

1. Explain the concepts and applications of Artificial Intelligence
2. Understand the essentials of feature engineering, state-of-art tools and concepts of machine learning
3. Design and evaluate different types of supervised learning algorithms for classification and regression tasks.
4. Design and evaluate different types of unsupervised learning algorithms for clustering tasks.
5. Design and evaluate strong learners for better real time prediction ensemble learning algorithms

## Unit-I:

**Introduction to Artificial Intelligence:**

Fundamentals of Artificial Intelligence Introduction to AI Representation, Non-AI & AI Techniques, Representation of Knowledge, Knowledge Base Systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, Identifying Problems Suitable for AI, Applications

**Unit-II:**

**Introduction to Machine Learning**

What is Machine Learning, Why Machine Learning, Types of Machine Learning models, Challenges of Machine Learning, Applications of Machine Learning, Essential libraries and Tools, Generalization over fitting and under fitting, Bias–variance trade-off, metrics

**Unit-III:**

**Supervised Learning**

Classification and Regression, Linear Regression: Single and Multiple, Logistic Regression, K-Nearest Neighbor, Naive Bayes Classifier, Decision Tree, Support Vector Machine

**Unit-IV:**

**Unsupervised Learning and Pre-processing**

Types of Unsupervised Learning, Challenges in Unsupervised Learning, Applications of Unsupervised Learning, Pre-processing and Scaling, clustering, K-Means Clustering, Agglomerative Clustering, Comparing and evaluating the clustering algorithms.

**Unit-V:**

**Ensemble Learning and Random Forest**

Voting Classifiers, Bagging and pasting, Random Patches and Random subspaces, Random Forest, Boosting-Ada Boost and Gradient Boost.

**Text Books:**


1. Elaine Rich and Kevin Knight: "Artificial Intelligence" Third Edition,Tata McGraw Hill,2009
2. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das "*Machine Learning*", Pearson Education India, 2018.
3. AurélienGéron, "*Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts,Tools, and Techniques to Build Intelligent Systems*" O'Reilly Media, Inc, 2017.


**Reference Books:**


1. Andreas C. Müller, Sarah Guido, "*Introduction to Machine Learning with Python*", O'Reilly Media, Inc, October 2016.
2. Tom M. Mitchell, "*Machine Learning*", McGraw-Hill Education (India) Private Limited, 2013.
3. EthemAlpaydin, "*Introduction to Machine Learning (Adaptive Computation and Machine Learning)*", The MIT Press, 2004.
4. Stephen Marsland, "*Machine Learning: An Algorithmic Perspective*", CRC Press, 2009.

# Electrical Machines- II Lab

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55203** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 0 | 0 | 3 | 1.5 | 50 | 50 | 100 |

## Course Objectives:

Course Objectives of EM-II Lab are to:

1. To understand the various tests performed on 1-Phase Transformers.
2. To study 3 phase to 2 phase conversion by means of Scott connections
3. To obtain performance of three phase induction motor from circle diagram.
4. To evaluate the different methods to calculate regulation of alternators.
5. To determine $X_d$&$X_q$ of Salient Pole Synchronous Machines

## Course Outcomes:

At the end of this EM-II Lab course, students will be able to

1. Connect two 1 phase transformers in parallel and study their operation, determine the various losses in the 1 phase transformers by performing necessary test
2. Connect two transformers in Scott connection and demonstrate 3 phase to 2 phase conversion.
3. Obtain the performance characteristics of 3-Phase Induction Motor.
4. Calculate voltage regulation of alternator by performing appropriate tests.
5. Draw V and inverted V curves for a given synchronous motors.

## List of Experiments:

### Part A

1. O.C. & S.C. Tests on single phase transformer.

2. Sumpner's test on a pair of single phase transformers.

3. Brake test on three phase squirrel cage induction motor.

4. No-load & blocked rotor tests on three phase Slip ring Induction motor.

5. Regulation of three phase alternator by synchronous impedance (EMF & MMF) method.

6. V and inverted V curves of three - phase Synchronous motor.

7. No Load and blocked rotor test on Single phase Induction Motor .

8. Slip test on salient pole synchronous machine.

**Part B**

1. Parallel Operation of Single Phase Transformers.

2. Separation of core losses of a single phase transformer.

3. Scott connection of Transformers.

4. Regulation of a three phase alternator by ZPF & ASA method.

5. Efficiency of a three phase alternator.

6. Measurement of sequence Impedance of a 3phase alternator.

**Note:-**All experiments from part A and two experiments from part B to be conducted.

## Skill Integrated Language Lab

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55241** | HSMC | L | T | P | C | CIE | SEE | Total |
| | | 0 | 0 | 2 | 1.0 | 50 | 50 | 100 |

### Course Objectives:

Course Objectives of SIL Lab are to:

1. To improve the students' fluency in English, through a well-developed vocabulary
2. To enable them to respond them appropriate socio-cultural and professional contexts.
3. They will be able to communicate their ideas relevantly and coherently in writing.

### Course Outcomes

At the end of this SIL Lab course, students will be able to

1. make oral presentations effectively
2. participate in group discussions
3. develop vocabulary
4. write project/Business reports
5. take part in social and professional communication

**Exercise I**

**Presentation Skills**:

Oral presentations (individual and group) / JAM sessions/Seminar - Power point presentations- Body Language-kinesics - Haptics

**Exercise II**

**Group Discussion:**

Dynamics of Group Discussion - Dos and Don'ts – Intervention - Summarizing - Modulation of Voice - Relevance - Fluency and Coherence

**Exercise III**

**Vocabulary Building**:

Synonyms and antonyms - Word Roots - One-Word Substitutes, - Prefixes and Suffixes - study of Word Origin- -Analogy -Idioms and Phrases

**Exercise IV**

**Writing Skills**:

Structure and presentation of different types of writing - Resume Writing /E-Correspondence/Statement of Purpose -Report Writing- Business Report Writing - Research Abilities/Data Collection/Organizing Data/Tools/Analysis

**Exercise V**

**Interview Skills**:

Concept and Process - Pre-Interview Planning - Opening Strategies - Answering Strategies - Interview through Telephone and Videoconferencing.

**A mini project should be given for the students to work in teams and the Assessment is done.**

**Minimum Requirements:**

The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a digital stereo –audio & video system.

**System Requirement (Hardware component):**

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) PIV Processor ,a) Speed – 2.8 GHZ

b) RAM – 512 MB Minimum

c) Hard Disk – 80 GB

ii) Headphones of High quality

**References:**


1. Dr. Rao, A. Ramakrishna., Dr. G. Natanam and Prof SA Sankaranarayana. *English Language Communication: A Reader cum Lab Manual. Chennai*: Anuradha Publications, 2008.
2. *English Vocabulary in Use series*. Cambridge University Press, 2008.
3. Nicholls, Anne. *Master Public Speaking.* JAICO Publishing House, 2006.
4. Sen, Leena. *Communication Skills.* New Delhi: PHI Learning Pvt Ltd, 2009

# Quantitative Aptitude and Reasoning

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A55288** | BSC-Lab | L | T | P | C | CIE | SEE | Total |
| | | 0 | 0 | 3 | 1.5 | 50 | 50 | 100 |

## Unit I:

**Number Systems**

Classification of numbers, Squares, Fractions, Simplifications, Divisibility Test, Power Cycle, Reminder Cycle, Factors, LCM, HCF, Application of LCM & HCF

**Ratio and Proportion:** Tricks to solve ratio, proportions, continuous proportions, Variations, Ages

**Percentages:** Percentage Increase/ Decrease , Results on population , Results on Depreciation, Simple Interest , Principal , Interest , Amount , Application of Simple Interest, Compound Interest , Compound Annually , Compound Half-yearly , Compound Quarterl, Difference between Compound Interest and Simple Interest

## Unit II:

**Geometry**

Lines , Properties of lines , Triangles, Properties of Triangles, Angles , Sectors , Chords , Planes , Quadrilateral

**Mensuration:** Area & Perimeter of Triangle, Quadrilateral, Rectangle, Square, Parallelogram, Trapezium, Surface Area & Volume of 3D Figures

**Data Interpretation:** Table Charts, Pie Charts, Bar Graphs, Line Graphs

**Data Sufficiency:** Problems On all quant and Logical topics

## Unit III:

**Seating Arrangement**

Circular arrangement, row arrangement, column arrangement, Square arrangement, Double row arrangement

**Syllogisms:** Two Statements & Conclusion, Three Statements & Conclusion, Six Statements

## Unit IV:

**Number Series**

Letter Series, Number Series, Letter & Number Series

**Analogy:** Simple Analogy, Double Analogy, Word Analogy, Number Analogy, Choosing Analogy Pairs

**Coding & Decoding:** Letter Coding, Number Coding, Symbol Coding, Letter - Number Coding, Letter - Symbol Coding, Direct Coding, Indirect Coding

**Blood Relations**: Based on Dialogue or conversation, Based on puzzles

## Unit V:

**Nouns**
Types of nouns, rules, usages and error spotting
**Pronouns:** Types of nouns, rules, usages and error spotting
**Articles:** Definite and indefinite articles, Omission of articles, rules, usage and error spotting
**Adjectives and Adverbs**: Types of nouns, rules, usages and error spotting
**Preposition**: Types of nouns, rules, usages and error spotting

**Text Books:**

1. Verbal and Non Verbal Reasoning - *R.S.Agarwal*.
2. Quantitative Aptitude - *R.S.Agarwal*.
3. Quantitative Aptitude - *Abhijit Guha*.

# Switch Gear and Protection

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56012** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of SGP are to:

1. To introduce students to power system protection and switchgear
2. To provide students the knowledge on theory, construction, applications of main types Circuit breakers, Relays
3. To understand the protection of generators and transformers.
4. To gain knowledge on protection of feeders from over- voltages and other hazards
5. To understand various types of neutral grounding and over voltage protection schemes.

## Course Outcomes:

At the end of this SGP course, students will be able to

1. Describe the operation principle of different types of circuit breakers and relays.
2. Illustrate various protection schemes used for Generators & transformers.
3. Analyze different protection schemes used in feeders and bus bars.
4. Distinguish between different types of Neutral Grounding and lightning arresters.
5. Explain the causes of over voltages in power systems and protection schemes used.

## Unit - I:

**Circuit Breakers**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages. - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Auto reclosures.

Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and $SF_6$ circuit breakers.

## Unit-II:

**Electromagnetic and Static Relays**

Principle of Operation and Construction of Attracted armature, Balanced Beam, Induction Disc and Induction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types.

Applications of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance and Mho Relays. Static relays:-introduction, phase comparators, amplitude comparators, static relays versus electromagnetic relays. Micro Processor based relays (Elementary Treatment Only).

**Unit-III:**

**Generator and Transformer Protection**

Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on (%) Winding Unprotected.

Protection of transformers: Percentage Differential Protection, Numerical Problems on Design of CTs Ratio in differential protection, Buchholtz relay Protection.

**Unit-IV:**

**Feeder and Bus-Bar Protection**

Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay. Protection of Bus bars – Differential protection

**Unit-V:**

**Neutral Grounding and Protection against Over Voltages**

Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages – Ground wires, Ground Rods and counter poise - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination.

**Text Books:**


1. Power System Protection and Switchgear - Badri Ram, D.N Viswakarma, TMH Publications.
2. Switchgear and Protection – Sunil S Rao, Khanna Publishers


**Reference Books:**


1. Transmission network Protection -Y.G. Paithankar, Taylor and Francis, 2009.
2. Power System Protection and Switch Gear - BhuvaneshOza, TMH 2010.
3. Electrical Power systems – C.L. Wadhwa, New Age International (P) Limited, Publishers, 6th Edition.

# Power System Operation & Control

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| | | L | T | P | C | CIE | SEE | Total |
| **A56013** | PCC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of PSOC are to:

1. To understand the economic operation of thermal Power Systems.
2. To demonstrate the necessity of economic dispatch in hydro thermal scheduling.
3. To model different power system components contributing for automatic generation control
4. To analyze single area load frequency control and 2 area load frequency control.
5. To know how to control reactive power in power system.

## Course Outcomes:

At the end of this PSOC course, students will be able to

1. Analyze the economic operation of thermal-thermal Power Systems.
2. Demonstrate the necessity of economic dispatch in hydro thermal scheduling.
3. Model different power system components contributing for Automatic Generation Control
4. Analyze single area load frequency control and 2 area load frequency control.
5. Explain the importance of reactive power control in power systems.

## Unit - I:

**Economic Operation of Power Systems**

Optimal operation of Generators in Thermal Power Stations, - Heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected.

Optimum generation allocation including the effect of transmission line losses – Loss coefficients, General transmission line loss formula.

## Unit - II:

**Hydro Thermal Scheduling**

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems-Short term hydrothermal scheduling problem.

**Unit- III:**

**Modeling of Turbine, Generator and Automatic Controllers**

Modeling of Governor: Mathematical Modeling of Speed Governing System – Derivation of small signal transfer function.

Modeling of Turbine: First order Turbine model, Block Diagram representation of Steam Turbines and Approximate Linear Models.

Generator – Load Model.

Modeling of Excitation System: Fundamental Characteristics of an Excitation system, Transfer function, Block Diagram Representation of IEEE Type-1 Model

**Unit- IV :**

**Load Frequency Control**

Necessity of keeping frequency constant. Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response –Controlled and Uncontrolled cases.

Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias Control. Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

**Unit-V:**

**Reactive Power Control**

Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

**Text Books:**


1. Modern Power system Analysis - D P Kothari and I J Nagrath - Tata McGraw-Hill - 4th Edition.
2. Power System Operation and Control **-** S*. Sivanagaraju*- Pearson Education India, 1st Edition.


**Reference Books:**


1. Operation and Control In Power Systems - P S R Murthy.
2. Power generation, Operation and Control –Allen J Wood.
3. Power System Analysis –C.L. Wadhwa, Newage International – 6th Edition.

# Microprocessors and Microcontrollers

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56014** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives of MPMC:

Course Objectives of MPMC are to:

1. To understand the architecture of 8085 and 8086
2. To learn instruction set to write assembly language programs for different addressing modes of 8086.
3. To learn 8086 interfacing with Programmable Peripheral Interfacing and Different peripherals.
4. To understand the assembly language programs of 8051 for simple applications.
5. To know the design 8051 interfacing with different peripherals.

## Course Outcomes:

At the end of this MPMC course, students will be able to

1. Write the assembly language programs of 8085 for simple applications.
2. Write assembly language programs for different addressing modes of 8086.
3. Apply the knowledge of interrupt structure of 8086, communication standards and Serial communication in 8086 interfacing.
4. Write the assembly language programs of 8051 for simple applications.
5. Design 8051 interfacing with different peripherals.

## UNIT-I:

8085 and 8086 Microprocessors: Evolution of microprocessors, 8085 Microprocessor, architecture and pin diagram, 8086 Microprocessor, architecture, register organization, memory segmentation, programming model, memory Addresses, physical memory organization, signal descriptions of 8086, timing diagrams.

## UNIT–II:

Instruction set 8085 and 8086 and assembly language programming of 8086: Instruction set of 8085, 8086 microprocessors, addressing modes, assembler directives, macros, simple programs involving logical, arithmetic expressions and string manipulations.

## UNIT–III:

8086 Interface: I/O Interface with 8255 PPI, various modes of operation and interfacing of 8086, Interrupt structure of 8086, 8251 USART architecture and interfacing, 8257 DMA controller to 8086, Memory interfacing to 8086, ADC to DAC interfacing with 8086, stepper motor and seven segment display interfacing to 8086.

**UNIT-IV:**

8051 Microcontroller Architecture, I/O ports, register set, Memory organization, Addressing modes and Instruction set of 8051, Interrupts in 8051, Interrupt Priority in the 8051.

**UNIT–V:**

8051 Interface Timers/Counters and Serial communication registers in 8051, Interface with Keyboard & Displays, Serial data communication and Timer/Counter Interfacing program.

**Text Books:**


1. Ramesh S Goankar, “Microprocessor Architecture Programming and Applications with the 8085, Penram International Pvt.Ltd.
2. A.K. Ray & Bhurchandi Advanced Microprocessors and peripherals – TMH publications.


**Reference Books:**


1. Kenneth Ayala and DhanunjayGadre, ‘The 8051 microcontroller’ Penram International/ Thomson,1995.
2. Douglas V Hall, “Microprocessors and Interfacing: Programming and Hardware”, 2nd, TMH publications.
3. 8086 Micro Processor -Kenneth J. Ayala, Penram International/ Thomson,1995.

# Electrical Measurements & Instrumentation

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56015** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of Electrical Measurements & Instrumentation are to:

1. To know the operation of various measuring instruments like Voltmeters/ Ammeters.
2. To study the basic principle of operation CT, PT, pf meters & frequency meters.
3. To understand the power measurement using wattmeters and energy measurement by using energy meters.
4. To learn how to measure the unknown voltage & current using potentiometer and to study the methods of measurement of R, L & C elements.
5. To study about oscilloscopes & Transducers and their applications.

## Course Outcomes:

At the end of this Electrical Measurements & Instrumentation course, students will be able to

1. Describe the construction, principle & operation of various measuring instruments.
2. Analyze the various measuring instruments in order to extend the range & minimize the errors
3. Measure3 phase active & reactive power by various methods.
4. Find unknown AC & DC emf, currents using various potentiometers&Use various bridges to find unknown R, L&C values and its quality & dissipation factors for capacitance.
5. Demonstrate the principle of operation of CRO and its applications &explain the importance and working principle of variousTransducers.

## Unit-I:

**Measuring Instruments**

Classification – deflecting, control and damping torques – Ammeters and Voltmeters – Permanent Magnet Moving Coil, Moving iron type instruments–expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series multipliers. Elementary treatment of Electrostatic Voltmeters – Extension of range of Electrostatic Voltmeters.

## Unit-II:

**Instrument Transformers**

Current Transformer and Potential Transformer – Ratio and phase angle errors- Numericals – design considerations- Type of P.F. Meters – dynamometer and moving iron type – 1-phase and

3-phase meters – Frequency meters – Resonance type and Weston type – Synchroscopes.

**Unit-III:**

**Measurement of Power and Energy**

Single phase dynamometer wattmeter, LPF and UPF, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems-Numericals

Single phase induction type energy meter – driving and braking torques – errors and compensations – testing-Numericals

**Unit IV:**

**Measurement of R, L & C and Potentiometers**

**Measurement of R, L & C:** Method of measuring Low Resistance with Kelvin's double bridge, Medium resistance –Whetstone's bridge, High resistance – loss of charge method.

Measurement of inductance, Quality Factor - Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge. Measurement of capacitance and loss angle - Desauty bridge– Schering Bridge-Numerical.

**Potentiometers**: Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate types–Numerical- applications.

**Unit- V:**

**Oscilloscopes, Digital Voltmeters and Transducers**

**Oscilloscopes:** Cathode ray Oscilloscope-Cathode ray tube-time base generator-Horizontal and vertical amplifiers-CRO probes-Applications of CRO-Measurement of phase and frequency-Lissajous patterns.

**Digital Voltmeters:** Successive approximation, Ramp, Dual-Slope integration type.

**Transducers:** Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT, LVDT Applications.

**Text Books:**


1. Electrical & Electronic Measurement & Instruments - A.K.SawhneyDhanpat Rai & Co. Publications, 3rd Edition
2. Electrical & Electronics measurements and Instrumentation- ER.R.K Rajput, S.Chand Publications-Fourth Edition

**Reference Books:**


1. Electrical Measurements – Buckingham and Price, PHI
2. Transducers and Instrumentation - D.V.S Murthy, Prentice-Hall Of India Pvt. Limited, 2nd edition, 2004.
3. Electrical Measurements: Fundamentals, Concepts, Applications – Reissland, M.U, New Age International (P) Limited, Publishers.
4. Electrical Measurements and measuring Instruments – E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publications.


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# Signals and Systems

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| | | L | T | P | C | CIE | SEE | Total |
| **A56016** | PEC-II | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of Signals & Systems are to:

1. To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series
2. To get the idea of signal representation in Fourier transforms domain and sampling
3. To understand operation of linear systems and corresponding responses of system
4. To present the concepts of convolution and correlation integrals and make the foundation for advanced courses.
5. To analyze the system using Laplace and Z-transforms

## Course Outcomes:

At the end of this Signals & Systems course, students will be able to

1. Represent any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.
2. Express periodic signals and non-periodic signals in terms of Fourier transform and representation of the spectrum and to design a system for sampling a signal.
3. Understand the principle of linear system, filter characteristics of a system and its band width,
4. Understand the concepts of auto correlation and cross correlation and power Density Spectrum.
5. Find Laplace transform and Z-transform of various signals and response of the system using Laplace transform and Z-transform

## UNIT-I:

**Signal Analysis and Fourier Series:**

Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**UNIT-II:**

**Fourier Transforms and Sampling**

Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function,

Sampling theorem–Graphical and analytical proof for Band Limited Signals, Types of Sampling -Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples.

**UNIT-III:**

**Signal Transmission Through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics,.

**UNIT-IV:**

**Convolution and Correlation of Signals:** Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Energy density spectrum, Parseval's Theorem, Power density spectrum, Relation between Auto Correlation function and Energy/Power spectral density function.

**UNIT-V:**

**Laplace Transforms and Z-Transforms**

Review of Laplace Transforms (L.T), Partial fraction expansion, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various classes of signals, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

Fundamental difference between Continuous and Discrete time signals, Discrete time signal representation using Complex exponential and Sinusoidal components, Periodicity of Discrete time signal using complex exponential signal, Concept of Z-Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

**Text Books:**


1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.


**References Books:**


1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
3. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.Publications, 2nd Edition, 2005.

# Advance Power Electronics Converters

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56017** | PEC-II | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of Advanced Power Electronics Converters are to:

1. To study controlled rectifier circuits with various types of passive filters.
2. To learn the basics of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. To understand the operation of 1 phase AC-DC single switch boost converter
4. To study the principle of operation of AC- DC bidirectional boost converter
5. To understand the operation of 1 phase AC-DC fly-back converter

## Course Outcomes:

At the end of this Advanced Power Electronics Converters course, students will be able to

1. Analyze thyristor rectifiers with different types of filtering Circuits
2. Compare and contrast 3,6 and 12 poles converter circuits
3. Explain the principle operation of single phase single switch boosts converters
4. Describe the operation of AC-DC bidirectional boost converter
5. Explain the operation of isolated single-phase AC-DC flyback converter

## Unit-I:

**Thyristor rectifiers with passive filtering**

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape.

## Unit-II:

**Multi-Pulse converter**

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

## Unit-III:

**Single-phase AC-DC single-switch boost converter**

Review of dc-dc boost converter, power circuit of single-switch AC-DC converter, steady state analysis, unity power factor operation, closed-loop control structure.

## Unit-IV:

**AC-DC bidirectional boost converter**

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase AC-DC boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

## Unit-V:

**Isolated single-phase AC-DC fly back converter**

DC-DC fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of AC-DC fly back converter, steady state analysis, unity power factor operation, closed loop control structure.

## Text Books:


1. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
2. G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.


## References Books:


1. J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", Addison-Wesley, 1991.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

# Industrial Electrical Systems

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56018** | PEC-II | L | T | P | C | CIE | SEE | Total |
| | | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of Industrial Electrical Systems are to:

1. To gain knowledge on various LT wiring system components
2. To study the requirements of residential and commercial electrical Systems
3. To study the components of HT and LT systems in detail.
4. To study DG Sets, UPS & Batteries in detail
5. To learn about industrial automation using PLC and SCADA.

## Course Outcomes:

At the end of this Industrial Electrical Systems course, students will be able to

1. Explain the various electrical system components
2. Design of residential and commercial wiring systems
3. Describe the HT, LT system
4. Selection of UPS, DG sets and batteries for various applications
5. Explain how industrial automation is achieved using PLC and SCADA

## UNIT-I

### Electrical System Components

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

## UNIT-II

### Residential and Commercial Electrical Systems

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, earthing of commercial installation, selection and sizing of components.

## UNIT-III

**Industrial Electrical Systems - I**

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

## UNIT-IV

**Industrial Electrical Systems - II**

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

## UNIT-V

**Industrial Electrical System Automation**

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

## Text Books:


1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating &Costing", Khanna publishers, 2008.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.


## Reference Books:


1. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
2. S. Singh and R. D. Singh, "Electrical estimating and costing", DhanpatRai and Co., 1997.Web site for IS Standards.

# Database Management Systems

| B. Tech III Year I Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| | | L | T | P | C | CIE | SEE | Total |
| **A56080** | ESC | 2 | 0 | 0 | 2 | 40 | 60 | 100 |

## Course Objectives:

Course Objectives of DMS are to:

1. Discuss Database management systems, databases and its applications
2. Familiarize the students with a good formal foundation on the relational model.
3. Outline the various systematic database design approaches
4. Describe the concepts of transactions and transaction processing and the issues, techniques related to concurrency and recovery manager.
5. Explore the File organizations, indexing and hashing mechanisms.

## Course Outcomes:

At the end of this DMS course, students will be able to

1. Model Entity-Relationship diagrams for enterprise level databases
2. Formulate Queries using SQL and Relational Formal Query Languages
3. Apply different normal forms to design the Database
4. Summarize concurrency control protocols and recovery algorithms
5. Identify suitable Indices and Hashing mechanisms for effective storage and retrieval of Data

## Unit I:

**Introduction to Database System Concepts:** Database-System Applications, Purpose of Database Systems, View of Data, Database Language, Database Design, Database Architecture, Database Users and Administrators.

**Introduction to the Relation Models and Database Design using ER Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity-Relationship Diagrams- Unary, Binary, ternary, Aggregation.

**Unit II:**

**Introduction to SQL:** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries.

**Formal Relational Query Languages:** The Relational Algebra, Tuple Relational Calculus.

**Unit III:**

**Relational Database Design:** Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional Dependencies, Closure set of Functional dependencies, Procedure for Computing $F^{+}$, Boyce Codd Normal form, BCNF Decomposition Algorithm, Third Normal Form, Third Normal Form Decomposition Algorithm

**Transactions:** Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Serializability.

**Unit IV:**

**Concurrency Control:** Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols.

**Recovery System:** Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, ARIES, Remote Backup Systems.

**Unit V:**

**File Organization:** Fixed and variable length records, Sequential file organization, Data Dictionary, Buffer manager.

**Indexing and Hashing:** Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Multiple-Key Access, Static Hashing, Extendible Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices.

**Text Book:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Sixth Edition, Tata McGraw-Hill 2006.

**Reference Books:**

1. Raghu Rama Kirshna, Johannes Gchrke, Database Management System, Third Edition, TATA MC Graw Hill, 2003.

2. C J Date, AKannan, S Swamynathan, An Introduction to Database Systems, Eigth Edition Pearson 2006

3. P Raja Sekhar Reddy, AMallikarjunaReddy, Foundations of Database Management Systems, Lambert Academic Publishing, 2020 ( e-Book)

4. https://www.pdfdrive.com/fundamentals-of-database-systems-pdf-e51477130.html

# Power Electronics and Simulation Lab

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56203** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 0 | 0 | 3 | 1.5 | 50 | 50 | 100 |

## Course Objectives:

Course Objectives of Power Electronics & Simulation Lab are to:

1. To provide basic foundation for analysis of performance of Power Electronics Converters and semiconductor switches.
2. To get practical exposure of different power electronic circuits like rectifiers, inverters, choppers and cyclo converters
3. To study the characteristics of MOSFET, IGBT, SCR
4. To understand the firing & commutation circuits used in thyristor based power electronic circuits
5. To design the simulate power electronic converters using appropriate software.

## Course Outcomes:

At the end of this Power Electronics & Simulation Lab course, students will be able to

1. Explain the characteristics SCR, IGBT and MOSFET
2. Investigate different firing and commutation circuits used in thyristor based power electronic circuits
3. Analyze the operation of voltage controllers
4. Examine the performance of various types of rectifiers, inverters, choppers and cyclo converters
5. Design various power electronic converters using simulation software.

## List of Experiments:

### PART – A

1. Study of Volt - Ampere characteristics of SCR, MOSFET & IGBT.
2. Gate firing circuits for SCR.
3. Single phase ac voltage controller with R and RL loads.

4. Single phase half-controlled bridge rectifier with R and RL loads with and withoutfreewheeling Diode.
5. Single phase fully controlled bridge rectifier with R and RL loads.
6. Forced commutation circuits (Class A, Class B, Class C, Class D & Class E).
7. DC Jones chopper with R and RL loads.
8. Single phase parallel inverter with R and RL loads.
9. Single phase series inverter with R and RL loads.
10. Single phase Cyclo converter with R and RL loads.

**PART –B**

1. Simulation of single phase full converter using RLE load.
2. Simulation of Single phase AC voltage controller using RLE load.
3. Simulation of single phase inverter with PWM control.
4. Simulation of 3-ph full converter using RLE load.

Note: Any 8 experiments from part – A and any 2 experiments from part - B.

# Measurements and Instrumentation Lab

| B. Tech III Year II Semester | | | | | Dept. of Electrical & Electronics Engineering | | | |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Category** | **Hours / Week** | | | **Credits** | **Marks** | | |
| **A56204** | PCC | L | T | P | C | CIE | SEE | Total |
| | | 0 | 0 | 3 | 1.5 | 50 | 50 | 100 |

## Course Objectives:

Course Objectives of Measurements & Instrumentation Lab are to:

1. To calibrate the various meters to find the % error in measuring various quantities.
2. To analyze the various measuring instruments in order to extend the range & minimize the errors.
3. To perform experiment for the measurement of 3 phase active, reactive power & choke coil parameters
4. To illustrate the capacitance pick up characteristics of LVDT.
5. To know how to use the various bridges to find unknown R, L&C values and its quality & dissipation factor of capacitance.

## Course Outcomes

At the end of this Measurements & Instrumentation Lab course, students will be able to

1. Calibrate the various measuring instruments.
2. Find the ratio & phase angle errors of CTs.
3. Measure the 3 phase active, reactive power & choke coil parameters.
4. Measure the unknown voltage & current using potentiometer.
5. Measure unknown values of R, L & C using appropriate bridges and calculate dissipation factor of capacitance

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

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Measurement of % ratio error and phase angle of given C.T. by comparison.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 phases reactive power with single-phase wattmeter.
8. LVDT and capacitance pickup – characteristics and Calibration

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

9. Calibration LPF wattmeter using Phantom loading.
10. Measurement of 3 phase power with single watt meter and 2 No's of C.T.
11. Dielectric oil testing using H.T. testing Kit
12. Measurement of Phase and Frequency using CRO.