Board of Studies Meeting

of

Department of Electrical and Electronics Engineering

held on 13.07.2021
Minutes of the Board of studies of Department of Electrical and Electronics Engineering
meeting held on 13-07-2021 at 11:00 AM.

The following members were present in the meeting:

<table>
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<tr>
<th>S. No</th>
<th>Name of the Member</th>
<th>Designation</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. A. Srujana, Professor and HOD/EEE, VJIT</td>
<td>Chairperson</td>
<td></td>
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<tr>
<td>2</td>
<td>Dr. K. H. Phani Sree, Associate Professor/EEE, JNTUH,</td>
<td>JNTUH Nominee</td>
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<tr>
<td>3</td>
<td>Mr. P. Chow Reddy, Managing Director, Interleaved Multidisciplinary Research Centre</td>
<td>External Member</td>
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<td>4</td>
<td>Dr. T. Anil Kumar, Professor &amp; HOD/EEE, Anurag University</td>
<td>External Member</td>
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<td>5</td>
<td>Dr. G. Suresh Babu, Professor &amp; HOD/EEE, CBIT</td>
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<tr>
<td>6</td>
<td>Dr. P. Ram Kishore Kumar Reddy, Professor &amp; HOD/EEE, MGIT</td>
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<td>7</td>
<td>Dr. D. B. G. Reddy, Professor/EEE, VJIT</td>
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<td>8</td>
<td>Dr. C. N. Ravi, Professor/EEE, VJIT</td>
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<td>9</td>
<td>Dr. M. Hari Krishna, Associate Professor/EEE, VJIT</td>
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<td>10</td>
<td>Dr. M. Dileep Krishna, Associate Professor/EEE, VJIT</td>
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<tr>
<td>11</td>
<td>Mr. B. Rajesh, Assistant Professor/EEE, VJIT</td>
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AGENDA

1. To discuss and decide the course structure and syllabi of II, III Year and IV Year B.Tech Electrical and Electronics Engineering for the students admitted under R20 Regulations (including FASTTRACK batch). Annexure - I

2. To discuss and decide the syllabi of the subjects offered by EEE Department for other departments admitted under R20 Regulations: Annexure - II
   1. Electrical Technology (for II B. Tech ECE II semester)
   2. Control Systems Engineering (for III B. Tech ECE I Semester)
   3. Basic Electrical Engineering (for II B. Tech Mechanical II Semester)
   4. Basic Electrical Engineering Laboratory (for II B. Tech Mechanical II Semester)
   5. Principles of Electrical Engineering (for II B. Tech Civil Engineering II Semester)

3. To discuss and decide substitute subjects for rejoined students of R19 regulation (VJIT Autonomous). Annexure - III

4. To Approve Panel of Examiners.

5. Any other matter with the permission of the Chair.
Item No.1: To discuss and decide the course structure and syllabi of II Year, III Year and IV Year B. Tech. Electrical and Electronics engineering for the students admitted under R20 Regulation

The Chairperson presented the course structure and syllabi of II Year, III Year and IV Year B. Tech. EEE subjects as per Annexure-I. After discussing various aspects of the Course Structure and syllabi the committee passed the following resolution.

Resolution(1): The members after thorough discussion approved the course structure and syllabi of III Year and IV Year B. Tech. in Electrical and Electronics Engineering for R20 Regulation as per Annexure-I

Noted and Approved.

Item No.2: To discuss and decide the course structure and syllabi of Fast track Curriculum scheme offered to III Year and IV Year B. Tech. Electrical and Electronics engineering for the students admitted under R20 Regulation

The Chairperson presented the course structure and syllabi of III Year and IV Year B. Tech. EEE Fast Track Curriculum Scheme (FTCS) subjects as per Annexure-I. After discussing various aspects of the Course Structure and syllabi the committee passed the following resolution.

Resolution(2): The members after thorough discussion approved the course structure and syllabi of Fast Track Curriculum Scheme (FTCS) offered to III Year and IV Year B. Tech. in Electrical and Electronics Engineering for R20 Regulation as per Annexure-I

Noted and Approved.

Item No.3: To discuss and decide the syllabi of the subjects offered by EEE Department to other departments admitted under R20 Regulation:

(i) The Chairperson presented the syllabi of subjects offered to B. Tech. ECE, Mechanical and Civil Engineering Branches viz:

1. Electrical Technology (for II B.Tech. ECE II semester)
2. Control Systems (for III B. Tech. ECE I Semester)

[Signatures]
3. Basic Electrical Engineering (for II B. Tech. Mechanical II Semester)
4. Basic Electrical Engineering Laboratory (for II B. Tech. Mechanical II Semester)
5. Principles of Electrical Engineering (for II B. Tech. Civil Engineering II Semester)

(ii) Further, the Chairperson presented subjects along with syllabi offered as Open Electives for other Branches of Engineering under R20 regulation in the college viz:
   1. Non Conventional Energy Sources (OE-1)
   3. Energy Audit and Conservation (OE-2)
   4. Principles of Electric Power Utilization (OE-2)
   5. Electric Vehicles and Hybrid Vehicles (OE-3)

After discussion and deliberation the committee approved the subjects along with the syllabi and passed the following resolution.

**Resolution (3):** The members after thorough discussion approved the syllabi of subjects offered to B. Tech. ECE, Mechanical and Civil Engineering Branches and Open Elective subjects offered to other Branches mentioned in Item 3 as per Annexure -II.

**Noted and Approved.**

**Item No. 4:** To discuss and decide substitute subjects for rejoined students of R20 regulation (VJIT Autonomous).

The Chairperson presented the substitute subjects for rejoining students of R20 ((VJIT Autonomous) as per Annexure - V

After discussing various aspects of the subjects the committee passed the following resolution

**Resolution (4):** The members after thorough discussion approved the substitute subjects for rejoined students of R20 (VJIT Autonomous) as per Annexure -III. The BoS Chairperson is authorized to choose and approve the substitute subjects for rejoined students.

**Noted and Approved.**
Item No. 5: To approve the Panel of examiners
The Chairperson explained on the requirement and emphasized on the panel of examiners, whose services will be utilized, as and when required for preparation of the question paper for End Semester examination and also for evaluation of the Answer scripts of the End Semester Examinations. The panel of the examiners will be prepared in consultation with the senior faculty of the department. They will be paid remuneration as per the recommendations of College Finance Committee.

Resolution (5): The committee of BoS, after discussion, authorized the Chairperson of BoS to prepare the Panel of examiners, as and when required in consultation with the senior faculty members for both B. Tech. (EEE) courses under R20 regulations. The same may be submitted to the Examination branch (Autonomous) for further processing.

Noted and Approved.
Annexure – I
# R20 B.TECH EEE SECOND YEAR COURSE STRUCTURE

## B. Tech. II Year I Semester

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<th>S. No.</th>
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<td>9</td>
<td>MC - 1</td>
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## B. Tech. II Year II Semester

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### R20 B.TECH EEE THIRD YEAR COURSE STRUCTURE

#### B. Tech. III Year I Semester

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<td>H&amp;S - 3</td>
<td>Managerial Economics and Financial Analysis</td>
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<td>PC - 8</td>
<td>Power Systems- II</td>
<td>3</td>
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<td>3</td>
<td>PC - 9</td>
<td>Power Electronics</td>
<td>3</td>
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<td>4</td>
<td>PC - 10</td>
<td>Microprocessors and Interfacing Devices</td>
<td>3</td>
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<tr>
<td>5</td>
<td>PE - 1</td>
<td>AI Techniques in Electrical Engineering /Integrated Circuits and Applications/Electrical Energy Conservation and Auditing</td>
<td>3</td>
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<tr>
<td>6</td>
<td>OE - 1</td>
<td>Non-Conventional Energy Sources/ Fundamentals of Electrical Power Generation and Protection</td>
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<tr>
<td>7</td>
<td>PC Lab - 5</td>
<td>Electrical Machines-II Lab</td>
<td>2</td>
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<td>8</td>
<td>PC Lab - 6</td>
<td>Advanced Communication Skills Lab</td>
<td>2</td>
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<td>9</td>
<td>VAC - 1</td>
<td>Personality Development &amp; Behavioral Skills</td>
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| Total | 20 | 0 | 4 | 21 |

#### B. Tech. III Year II Semester

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<td>Essentials of Computer Networks</td>
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<td>Computer Methods in Power Systems</td>
<td>3</td>
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<td>PC - 12</td>
<td>Power Semiconductor Drives</td>
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<td>PC - 13</td>
<td>Switch Gear and Protection</td>
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<td>PE - 2</td>
<td>Modern Power Electronics/ Advanced Control Systems / System Design using Verilog HDL</td>
<td>3</td>
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<td>OE - 2</td>
<td>Energy Auditing and Conservation/Principles of Electric Power Utilization</td>
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<td>PC Lab - 7</td>
<td>Control Systems and Simulation Lab</td>
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<td>Quantitative Methods &amp; Logical Reasoning</td>
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| Total | 20 | 0 | 4 | 21 |
## R20 B.TECH EEE FOURTH YEAR COURSE STRUCTURE

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### R20 COURSE STRUCTURE (for FAST TRACK)

#### B. Tech. IV Year I Semester

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#### B. Tech. IV Year II Semester

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## B.TECH SECOND YEAR COURSE STRUCTURE & SYLLABUS

### B. Tech. II Year I Semester

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### B. Tech. II Year II Semester

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B. Tech. II Year I Semester

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

1. Apply network theorems for the analysis of electrical networks.
2. Obtain the transient and steady-state response of electrical circuits.
3. Examine graph theory to formulate network equations.
4. Analyze two port networks.
5. Evaluate circuits in the sinusoidal steady-state (Three-phase).

UNIT I
NETWORK THEOREMS (DC & AC), MESH AND NODAL ANALYSIS:
Analysis of Circuits using Mesh and Nodal methods, Norton’s theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman’s theorem and Compensation theorem.

UNIT II
D.C AND A.C TRANSIENT ANALYSIS:
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for D.C excitation- Initial conditions- Solution method using differential equation and Laplace transforms.
Transient response of R-L, R-C, R-L-C circuits (series and parallel) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms.

UNIT III
NETWORK TOPOLOGY:
Network Topology - Definitions, Graph, Tree, Incidence Matrix, Basic Cut Set and Basic Tie Set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Voltage and Current Sources, Duality & Dual Networks.

UNIT IV
TWO PORT NETWORKS:
Two port network parameters - Z, Y, ABCD and Hybrid parameters and their inter relations. Series, parallel and cascaded connection of two port networks, Concept of transformed network - Two port network parameters using transformed variables.
NETWORK ANALYSIS

B. Tech. II Year I Semester

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

1. Apply network theorems for the analysis of electrical networks.
2. Obtain the transient and steady-state response of electrical circuits.
3. Examine graph theory to formulate network equations.
4. Analyze two port networks.
5. Evaluate circuits in the sinusoidal steady-state (Three-phase).

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Transient response of R-L, R-C, R-L-C circuits (series and parallel) for sinusoidal excitation- Initial conditions- Solution method using differential equation and Laplace transforms.

UNIT III
NETWORK TOPOLOGY:
Network Topology - Definitions, Graph, Tree, Incidence Matrix, Basic Cut Set and Basic Tie Set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Voltage and Current Sources, Duality & Dual Networks.

UNIT IV
TWO PORT NETWORKS:
Two port network parameters - Z, Y, ABCD and Hybrid parameters and their inter relations. Series, parallel and cascaded connection of two port networks, Concept of transformed network - Two port network parameters using transformed variables.
UNIT V
ANALYSIS OF THREE PHASE CIRCUITS:
Three phase Circuits - Generation of Three Phase Voltage - Review of Voltage and Current relations in Star and Delta systems. Analysis of balanced and unbalanced three phase circuits - Measurement of active and reactive power.

TEXT BOOKS

REFERENCE BOOKS
ELECTRO MAGNETIC FIELDS

B. Tech. II Year I Semester

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

1. Understand the basic laws of electromagnetism.
2. Compare the electric and magnetic fields concepts for simple configurations under static conditions.
3. Illustrate time varying magnetic fields.
4. Examine Maxwell's equations in different forms and different media.
5. Apply electromagnetic concepts to electrical machines.

UNIT I
ELECTROSTATICS:

UNIT II
DIPOLAR & CAPACITANCE:

UNIT III
MAGNETOSTATICS, AMPERE'S CIRCUITAL LAW:
Biot-Savart's law - Magnetic field intensity (MFI) - MFI due to a straight current carrying filament- MFI due to circular and solenoid current Carrying wire, Relation between magnetic flux, magnetic flux density, Maxwell's second Equation.

Ampere's circuital Law & Applications:
Ampere's circuital law and its applications viz. - MFI due to an infinite sheet of current and a long current carrying filament, Point form of Ampere's circuital law - Curl-Stroke's Theorem, Maxwell's third equation.
UNIT IV

FORCE IN MAGNETIC FIELDS, MAGNETIC POTENTIAL:
Magnetic force - Lorentz force equation - force on a current element in a magnetic field.
Force on a straight and a long current carrying conductor in a magnetic field - Force between
two straight long and parallel current carrying conductors - Magnetic dipole and dipole
moment - Torque in a magnetic field. Scalar Magnetic potential and its limitations, vector
magnetic potential and its properties.

UNIT V

INDUCTANCE, TIME VARYING FIELDS:
Self and Mutual inductances, Determination of self-inductance of a solenoid, toroid and
mutual inductance between a straight long wire, Energy stored and Density in a Magnetic
field. Time varying fields - Faraday's laws of electromagnetic induction, Maxwell's fourth
equation - Simple problems, Modification of Maxwell's equations for time varying fields,
Displacement current.

TEXT BOOKS


REFERENCE BOOKS

3. Electromagnetic field theory, K. A. Gangadhar, P. M. Ramanathan, Khanna Publishers-
ELECTRICAL MACHINES-I

B. Tech. II Year I Semester

Course Outcomes: At the end of this course, students will be able to
1. Understand different parts of DC Generators & understand its operation.
2. Explain the operation of DC motors.
3. Illustrate the different testing methods of DC machines.
4. Examine the constructional and operation of single phase transformers.
5. Analyze three phase transformers connections.

UNIT - I

UNIT - II
D.C Motors: Principle of operation - Back E.M.F. - Torque equation - characteristics and applications of shunt, series and compound motors - Necessity of starter, principle of operation of 3-point and 4-point starters with protective devices, Speed control of D.C. Motors - Armature voltage and field flux control methods.

UNIT - III
Testing of DC Machines: Losses - Constant & Variable losses - calculation of efficiency - condition for maximum efficiency. Methods of Testing - direct, indirect, and regenerative testing - Brake test - Swinburne’s test - Hopkinson’s test - Field’s test - separation of stray losses in a d.c. motor.

UNIT - IV
Single Phase Transformers: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams Equivalent circuit - losses and efficiency - regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

UNIT - V
Testing of Transformers and Poly-Phase Transformers: OC and SC tests - Sumpner’s test - determination of efficiency and regulation-separation of core losses-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers - Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/ Δ and open Δ
TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes: Upon the completion of laboratory course, the student will be able to

1. Correlate the data using plots.
2. Verify network theorems.
4. Simulate rectifier circuits.
5. Analyze networks using network theorems.

Any Ten of the following experiments should be conducted:

1. Basic operation on matrices.
2. Basic 2D plots of simple equations.
3. Find loop currents using mesh analysis.
4. Find node voltage using nodal analysis.
5. Transient analysis of RL series circuit.
8. Analysis of half wave rectifier with and without filter.
9. Analysis of full wave rectifier with and without filter.
10. Verification of Thevenin's theorem.
11. Verification of Maximum power transfer theorem.
12. Verification of super position theorem.
ELECTRICAL CIRCUITS LAB

B. Tech. II Year I Semester

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Evaluate response in a given network by using network theorems.
2. Analyze complex DC and AC linear circuits.
3. Apply concepts of electrical circuits.
4. Evaluate active power and reactive power of electric circuits.
5. Determine two port network parameters.

Any Ten of the following experiments should be conducted

1. Measurement of voltage, current and equivalent resistance of various circuits.
2. Verification of Norton’s theorem.
3. Verification of maximum power transfer theorem on DC excitation.
4. Verification of compensation theorem.
5. Verification of reciprocity theorem & Millman’s theorem.
7. Determination of self-inductance, mutual inductance and coefficient of coupling.
8. Locus diagrams of series RL and RC circuits.
9. Calculation of RMS, average values, form factor and peak factor of complex waveform.
10. Determination of Z & Y parameters.
11. Determination of transmission & hybrid parameters.
12. Measurement of active power for three phase balanced loads.
13. Measurement of reactive power for three phase balanced loads.
Course Outcomes: At the end of the course, student will be able to
1. Understand the applications of Python programming in the area of electrical and electronics engineering.
2. Write programs on functions, modules and packages.
3. Apply Lists, Tuples, Dictionaries and matrix operations in Python
4. Enhance logical thinking and implementation of the electrical and electronic principles into a working code.

UNIT I
Introduction to Python:
History of python, Features of Python Language, understanding wide range of Python applications, Literal Constants, Comments, Reserved Words, Variables and Identifiers, Data Types, functions (Arguments, Return & In-built functions), Operations (Integers and floats, Strings, Type Conversions & Booleans), Expressions, Type Conversion.

Control Statements: Selection / Conditional Branching Statements, Loops (IF, IF - else & elif, for and while). Break and continue.

UNIT II
Functions and Modules:
Function Definition, Function Calling, return statement, Types of Arguments: Required, Keyword, Default Variable-length, Pandas and NumPy Packages in Python, Doc Strings.
Lists: Basic operations, list methods, looping in lists, Dictionaries, Tuples, Sets, Arrays, Exceptions, Tuples: Creating Tuple, Accessing Values in a Tuple, Basic Tuple Operations, Nested Tuples, index() and count() methods of tuple, Variable-length Argument Tuples, zip() Function, Advantages of Tuple over List.

UNIT III
Dictionaries: Creating a Dictionary, Accessing Values, Modifying an Entry, Deleting Items, Sorting Items in a Dictionary, Nested Dictionaries, Built-in Dictionary Functions and Methods.Difference between a List and a Dictionary
NumPy package: Array, Matrix and associated operations, Linear algebra and related operations, Data visualization on dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

UNIT IV
Boolean Algebra& Logic Gates: Boolean operations, Boolean functions, Algebraic manipulations, Min-terms and Max terms, Sum-of-products and Product-of-sum representations, Two-input logic gates, NAND /NOR Implementations using Python programming.
UNIT V
An Engineering perspective: Simulating a basic resistive circuit, The working of a diode using simulations, Basics of magnetic and electric fields. Study of inductors and capacitors, Phasor diagrams, writing control functions using Python, Simulating a transformer and magnetic circuits.

Text Books

Reference Books
1. Fundamentals of Python, Kenneth A. Lambert
B. Tech. II Year II Semester

Course Outcomes: At the end of this course, students will be able to

1. Understand the concepts of poly phase induction machines.
2. Examine the operation of induction motors.
3. Analyze performance characteristics of synchronous machines.
4. Evaluate the performance characteristics of Synchronous Generators.
5. Assess the construction and operation of synchronous motors and special machines.

UNIT I

Poly-Phase Induction Machines: Constructional details of cage and wound rotor machines - production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Induction generator - principle of operation (elementary treatment only).

UNIT II

Characteristics of Induction Motor: Rotor power input, rotor copper loss and mechanical power developed. Torque equation - expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging - No-load Test and Blocked rotor test - Predetermination of performance - Methods of starting and starting current and Torque calculations.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, and injection of an EMF into rotor circuit (qualitative treatment only).

UNIT III

Synchronous Machines: 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-IV

Regulation and Parallel operation of Synchronous Machine:


Parallel Operation of Synchronous Machines: Synchronizing alternators with infinite bus bars - synchronizing power torque - parallel operation and load sharing - Effect of change of excitation and mechanical power input.
UNIT-V
Synchronous Motors and Special Machines:
Synchronous Motors: Theory of operation - Methods of starting - phasor diagram - Variation of current and power factor with excitation - synchronous condenser - Mathematical analysis for power developed - hunting and its suppression - synchronous induction motor.

Special Machines:
Principles of operation of Reluctance Motors, Permanent magnet Brushless DC Motors.

TEXTBOOKS:

REFERENCE BOOKS:
Course Outcomes: At the end of the course, the student will be able to

1. Understand the principle of generation of electric power in thermal, hydro, nuclear and gas power stations.
2. Apply concepts in distribution systems to solve problems.
3. Interpret the arrangement and operation of AIS and GIS substations.
4. Analyze methods to improve the power factor and voltage control.
5. Evaluate various power tariff methods.

UNIT I
POWER STATIONS:
Thermal Power Stations: Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses. Brief description of TPS components-Economizers, Boilers, Super heaters, Turbines, Condensers, Chimney and cooling towers.


Nuclear Power Stations: Nuclear Fission and Chain reaction, Nuclear fuels, Principle of operation of Nuclear reactor, Reactor Components- Moderators, Control rods, Reflectors and Coolants, Radiation hazards- Shielding and Safety precautions, Types of Nuclear reactors and brief description of PWR,BWR and FBR.

Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only).

UNIT II
D.C & A.C DISTRIBUTION SYSTEMS:
D.C Distribution Systems: Classification of Distribution Systems - Comparison of DC vs. AC and Under-Ground vs. Over -Head Distribution Systems- Requirements and Design features of Distribution Systems Voltage, Drop Calculations (Numerical Problems in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal voltages) and Ring Main Distributor.

Distribution Systems: Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to related load voltages.
UNIT III
AIR INSULATED & GAS INSULATED (GIS) SUBSTATIONS:
Classification of substations: - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Station: Simple arrangements like single busbar, sectionalized single busbar, main and transfer busbar system with relevant diagrams.
Gas Insulated Substations (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, busbar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT IV
POWER FACTOR & VOLTAGE CONTROL:

UNIT V
ECONOMIC ASPECTS OF POWER GENERATION & TARIFF:
Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems.

TEXT BOOKS:

REFERENCE BOOKS:
CONTROL SYSTEMS

B. Tech. II Year II Semester

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

1. Understand the fundamentals of classical control systems.
2. Apply transfer function reduction techniques and Time response analysis for standard test signals.
3. Examine stability and frequency responses of first and second-order systems.
4. Classify different types of Controller design.
5. Represent linear time systems in State space

UNIT I

INTRODUCTION TO CONTROL PROBLEM:

UNIT II

TRANSFER FUNCTION REDUCTION TECHNIQUES
Block diagram algebra and Signal Flow Graph

TIME RESPONSE ANALYSIS OF STANDARD TEST SIGNALS:

UNIT III

CONCEPT OF STABILITY

FREQUENCY-RESPONSE ANALYSIS:
UNIT IV
INTRODUCTION TO CONTROLLER DESIGN:

UNIT V
STATE VARIABLE ANALYSIS AND CONCEPTS OF STATE VARIABLES:

TEXT BOOKS:

REFERENCE BOOKS:
ELECTRICAL MACHINES - I LAB

B. Tech. II Year II Semester

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Start and control the Different types of DC motors.
2. Assess the performance of different types of DC machines using different testing methods.
3. Identify different conditions required to be satisfied for self - excitation of DC Generators.
4. Separation losses of DC motor into different components.
5. Analyze the performance of coupled machines.

Any 10 out of the following 12 experiments should be conducted:

1. Magnetization characteristics of a DC shunt generator.
2. Load test on DC shunt generator.
3. Load test on DC compound generator.
4. Load test on DC series generator.
5. Brake test on DC compound motor.
6. Hopkinson's test on DC Shunt machines.
7. Field's test on DC Series machines.
8. Separation of losses in DC shunts motor.

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

1. Retardation test on DC shunt motor.
2. Speed control of DC shunt motor.
3. Swinburne's test on DC shunt machine.
4. Brake Test on DC shunt Motor.
# R20 B.TECH THIRD YEAR COURSE STRUCTURE

## B. Tech. III Year I Semester

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**Total** 20 0 4 21

## B. Tech. III Year II Semester

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**Total** 20 0 4 21
## R20 COURSE STRUCTURE (for FAST TRACK)

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

1. Understand transmission line parameters.
2. Observe the performance of transmission lines.
3. Analyze transient behavior of transmission lines.
4. Evaluate mechanical design of transmission lines.
5. Understand the construction, grading and capacitance of underground 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 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT II
PERFORMANCE OF SHORT, MEDIUM AND LONG LENGTH TRANSMISSION LINES:


UNIT III
POWER SYSTEM TRANSIENTS:

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Incident, Reflected and Refracted Waves - 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 IV
FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSION LINES, TRANSMISSION LINE INSULATORS, SAG AND TENSION CALCULATIONS:


UNIT V
UNDERGROUND CABLES:


TEXT BOOKS:

REFERENCE BOOKS:
2. Power System Engineering, I.J. Nagaratn and D.P. Kothari, TMG.
B. Tech. III Year I Semester

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

1. Understand about various power electronic devices and their commutation procedure.
2. Discuss the operation of various single phase-controlled converters.
3. Examine operation of various three phase-controlled converters and AC voltage controllers.
4. Identify the operation of DC-DC converters.
5. Analyze the operation of DC-AC converters.

UNIT I
POWER SEMI CONDUCTOR DEVICES & COMMUNICATION CIRCUITS:

THYRISTORS: Silicon Controlled Rectifiers (SCR's), BJT, Power MOSFET, Power IGBT, their characteristics and other thyristors. Basic theory of operation of SCR, Static characteristics, Turn on and turn off methods. Dynamic characteristics of SCR - Turn on and Turn off times - Salient points. Two transistor analogy. UJT firing circuit, Series and parallel connections of SCR’s, Snubber circuit details - Specifications .Ratings of SCR’s, BJT and IGBT - Line Commutation and Forced Commutation circuits. Numerical problems

UNIT II
AC-DC CONVERTERS (1-PHASE CONTROLLED RECTIFIERS):

Phase control techniques, Single phase Line commutated converters, Midpoint and Bridge connections, Half controlled converters with R, RL and RLE loads. Derivation of average load voltage and current-Active and Reactive power inputs to the converters without and with Freewheeling Diode Numerical problems. Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load 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
AC-DC CONVERTERS (3-PHASE CONTROLLED RECTIFIERS):

AC-AC CONVERTERS (AC VOLTAGE CONTROLLERS) & FREQUENCY CHANGERS (CYCLO CONVERTERS):


UNIT IV
DC-DC CONVERTERS (CHOPPERS):


UNIT V
DC-AC CONVERTERS (INVERTERS):


TEXT BOOKS:

REFERENCE BOOKS:
1. Power electronics devices, circuits and industrial applications, V. R. Moorthy, Oxford University Press.
ARTIFICIAL INTELLIGENCE TECHNIQUES IN ELECTRICAL ENGINEERING
(Professional Elective-1)

B. Tech. III Year II Semester

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

3. Identify fuzziness involved in various systems and fuzzy set theory.
4. Discover fuzzy logic control for applications in electrical engineering.
5. Interpret genetic algorithm for applications in electrical engineering.

UNIT I
ARTIFICIAL NEURAL NETWORKS:

UNIT II
ANN PARADIGMS:
Multi-layer perceptron using Back propagation Algorithm (BPA), Self -Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT III
FUZZYLOGIC:

UNIT IV
GENETIC ALGORITHMS:
Introduction-Encoding Fitness Function-Reproduction operators, Genetic Modeling Genetic operators-Cross over-Single site cross over, Two point cross over Multi point cross over Uniform cross over, Matrix cross over-Crossover Rate-Inversion & Deletion, Mutation operator Mutation Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.
UNIT V
APPLICATIONS OF AI TECHNIQUES:

Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS:


REFERENCE BOOKS:

2. Neural network & fuzzy system, Bart Kosko, PrenticeHall.
ELECTRICAL ENERGY CONSERVATION AND AUDITING
(Professional Elective-1)

B. Tech. III Year I Semester

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

1. Understand the current energy scenario and importance of energy conservation.
2. Apply the concepts of energy management.
3. Evaluate energy efficiency in different electrical systems.
4. Describe the energy audit of different energy systems.
5. Analyze the energy audit of different energy systems.

UNIT I
ENERGY SCENARIO:
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution and climate change. Energy Conservation Act- 2001 and its features.

UNIT II
BASICS OF ENERGY AND ITS VARIOUS FORMS:
Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT III
ENERGY MANAGEMENT & AUDIT:
Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.
Energy Efficiency in Electrical Systems


UNIT IV
ENERGY EFFICIENCY IN INDUSTRIAL SYSTEMS:


UNIT V
ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS:

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls and energy saving potential of each technology.

TEXT BOOKS:

REFERENCE BOOKS:
2. Success stories of energy conservation by BEE, New Delhi.
Course Outcomes: At the end of the course, the student will be able to

1. Realize the importance of renewable energy sources for energy planning.
2. Understand the value of solar energy potential and exploit the solar energy for real world applications.
3. Describe the potential of wind energy, types of wind mills, performance characteristics and Betz criteria.
4. Analyze the potential of both tidal and ocean thermal energies and learn the extraction methods.
5. Know the potential of geothermal, bio-mass energies and learn relevant extraction methods.

UNIT I
PRINCIPLE OF RENEWABLE ENERGY:

Comparison of renewable and conventional energy sources, ultimate energy sources, natural energy currents on earth, primary supply to end use, spaghetti & pie diagrams, energy planning - energy efficiency and management.

UNIT II
SOLAR RADIATION:

Extra-terrestrial and terrestrial solar radiation, solar thermal conversion, solar thermal central receiver, photovoltaic energy conversion, solar cell configurations.

UNIT III
WIND ENERGY:

Planetary and local winds, vertical and horizontal axis wind mills, principles of wind power - maximum power and actual power, wind turbine operation - Sources and potentials, horizontal and vertical axis windmills, performance characteristics and Betz criteria.

UNIT IV
ENERGY FROM OCEANS:

Ocean thermal energy - principles of OTEC plant operations. Wave energy - devices for energy extraction. Tides: types of tidal stations.
UNIT V
GEOTHERMAL AND BIO FUEL ENERGY:


TEXT BOOKS:

REFERENCE BOOKS:
1. Power plant technology, EL-Wakil, McGraw-Hill.
FUNDAMENTALS OF ELECTRICAL POWER GENERATION AND PROTECTION
(Open Elective I)

B. Tech. III Year 1 Semester

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

1. Interpret the operation of thermal power station through its schematic diagram.
2. Observe the arrangement of hydroelectric power station through its components.
3. Examine various components of nuclear power station.
4. Describe the operation of gas and diesel power station through its schematic diagram.
5. Differentiate various power system protection components.

UNIT I
THERMAL POWER STATIONS:

Introduction to generating stations - Steam Power Stations, advantages and disadvantages, Schematic arrangement of Steam power system, choice of site of steam power station, efficiency of steam power station and equipment of steam power station.

UNIT II
HYDRO ELECTRIC POWER STATION:

Introduction, advantages and disadvantages, Schematic arrangement of hydro electric power station, choice of site for Hydro electric power station, constituents of hydro electric power station and pumped storage plants.

UNIT III
NUCLEAR POWER STATIONS:

Introduction, advantages and disadvantages, selection of site for nuclear power station, nuclear fission and chain reaction. Nuclear fuels, principle of operation of nuclear reactor, schematic arrangement of nuclear power stations, components of Nuclear Power plant, radiation hazards: Shielding and Safety precautions.

UNIT IV
GAS AND DIESEL POWER STATION:

UNIT V
INTRODUCTION TO POWER SYSTEM PROTECTION COMPONENTS (ELEMENTARY TREATMENT ONLY):

Fuses-Definition, advantages, disadvantages of fuses, desirable characteristics of fuses, fuse element materials and important terms. Circuit Breakers: definition, important terms and Comparison of fuse and Circuit breaker Isolators: Protective relay, Requirement of Protective relay, electrical Hazards and need of earthing.

TEXT BOOKS:

REFERENCE BOOKS:
2. Electrical Power Generation: Transmission and distribution, S.N. Singh, PHI.
B. Tech. III Year I Semester

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Understand the basic working principle of a transformer; obtain the equivalent circuit parameters, estimate efficiency & regulation at various loads of 1-Φ transformers.
2. Examine load sharing of transformers & conversion of 3- Φ to 2- Φ supply.
3. Determine the equivalent circuit parameters of a single phase induction motor; determine the performance characteristics and efficiency by direct and indirect methods of three phase induction motor.
4. Analyze the regulation of an alternator by various methods at different power factors.
5. Assess synchronous motor performance curves at various power factors and field currents.

Any Ten of the following experiments are required to be conducted.

1. Sumpner's test on a pair of single phase transformer.
2. Separation of core losses of a single phase transformer.
3. Scott connection of transformer and Parallel operation of single phase transformer.
4. No-load & Blocked rotor tests on three phase induction motor.
5. Regulation of a three – phase alternate by synchronous impedance M.M.F methods.
8. Determination of Xd and Xq of a salient pole synchronous machine.

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

10. Determination of sequence impedances of a three-phase alternator.
11. Determination of sequence impedances of a three-phase transformer.
12. Speed control of three phase slip ring Induction Motor.
B. Tech. III Year II Semester

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

1. Demonstrate the knowledge and ability to develop Y-bus and Z-bus matrices.
2. Apply the concepts of load flow studies.
3. Analyze different types of faults
4. Identify power system steady state stability of power system.
5. Investigate methods to improve transient state stability of power system.

UNIT I
POWER SYSTEM NETWORK MATRICES:

Graph Theory: Definitions, Bus Incidence Matrix, Y-bus formation by Singular Transformation Methods and Direct Inspection methods, Numerical Problems.


UNIT II
POWER FLOW STUDIES:


LOAD FLOW SOLUTION USING GAUSS SEIDEL METHOD: Acceleration Factor, Load flow solution without and with P-V buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

NEWTON RAPHSON METHOD IN RECTANGULAR AND POLAR CO-ORDINATES FORM: Load Flow Solution without and with PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart (Max. 3-Buses).

DECOUPLED AND FAST DECOUPLED METHODS: Comparison of Different Methods DC load Flow.
UNIT III
SHORT CIRCUIT ANALYSIS:


SYMMETRICAL FAULT ANALYSIS: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.


UNSYMMETRICAL FAULT ANALYSIS: LG, LL, LLG faults without and with fault impedance, Numerical Problems.

UNIT IV
STEADY STATE STABILITY ANALYSIS:


UNIT V
TRANSIENT STABILITY ANALYSIS:


TEXT BOOKS:
1. Power system analysis, Dr. N. V. Ramana, Pearson Education India.
2. Computer methods in power system analysis, Stagg and EL-Abiad, McGraw Hill

REFERENCE BOOKS:
2. Power system analysis, A. Nagoorkanl, RBA Publications-3rd Edition
POWER SEMICONDUCTOR DRIVES

B. Tech. III Year II Semester

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

1. Understand the concepts of the dynamics of electric drives and speed control of different types of DC drives.
2. Examine four quadrant operation to control speed of DC drives using dual converters.
3. Classify four quadrant operation to control speed of DC drives using choppers.
5. Investigate speed control methods of synchronous motor drives.

UNIT I
CONTROL OF DC MOTORS THROUGH PHASE CONTROLLED RECTIFIERS:

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to DC separately excited and DC series motors - continuous current operation output voltage and current waveforms - Speed and Torque expressions Speed Torque Characteristics - Problems on Converter fed DC motors. Three phase semi and fully controlled converters Connected to DC separately excited and DC series motors output voltage and current waveforms Speed and Torque expressions Speed Torque characteristics - Problems.

UNIT II
FOUR QUADRANT OPERATIONS OF DC DRIVES THROUGH DUAL CONVERTERS:

Introduction to Four quadrant operation Motoring operations, Electric Braking Plugging, Dynamic and Regenerative Braking operations, Four quadrant operation of DC motors by dual converters Closed loop operation of DC motor (Block Diagram Only).

UNIT III
CONTROL OF DC MOTORS BY CHOPPERS (1, 2, 4 QUADRANT OPERATIONS):

Single quadrant, Two quadrant and four quadrant chopper fed separately excited and series excited motors Continuous current operation Output voltage and current waveforms Speed torque expressions speed torque characteristics Problems on Chopper fed DC Motors Closed Loop operation (Block Diagram Only).
UNIT IV
CONTROL OF INDUCTION MOTORS:

Variable voltage & Frequency Characteristics: Control of Induction Motor by AC Voltage Controllers Waveforms speed torque characteristics. Variable frequency control of induction motor by Voltage source and current source Inverter and cyclo-converters- PWM control - Comparison of VSI and CSI operations Speed torque Characteristics numerical problems on induction motor drives. Closed loop operation of induction motor drives (Block Diagram Only).

Static rotor resistance control: Slip power recovery Static Scherbius drive Static Kramer Drive their performance and speed torque characteristics advantages applications - problems.

UNIT V
CONTROL OF SYNCHRONOUS MOTORS:


TEXTBOOKS:

REFERENCE BOOKS:
1. Power semiconductor drives, PV Rao, BS Publications.
B. Tech. III Year II Semester

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

1. Understand basic working of circuit breaker and classification of circuit breakers.
2. Examine different types of circuit breakers in power systems.
3. Analyze Principle of operation of over current, directional, differential and distance relays.
4. Design protection schemes for alternators, transformers, bus-bars.
5. Assess over voltage protection and insulation level

UNIT I
CIRCUIT BREAKERS:

UNIT II
ELECTROMAGNETIC, STATIC RELAYS & NUMERICAL RELAYS:

UNIT III
GENERATOR & TRANSFORMER PROTECTION:
UNIT IV
FEEDER AND BUS BAR PROTECTION & GROUNDING PROTECTION OF LINES:

Over current earth fault, Carrier current and three zone distance protection using impedance relays—Translay relay Protection of bus bars and Differential protection.

NEUTRAL GROUNDING

UNIT V
PROTECTION AGAINST OVER VOLTAGE AND GROUNDING:


TEXT BOOKS:

REFERENCE BOOKS:
MODERN POWER ELECTRONICS
(Professional Elective-2)

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

1. Define the advances in power electronic devices.
2. Articulate power electronic resonant converters in power control applications.
3. Evaluate the design and control of multi-level inverters.
4. Articulate DC power supplies in Power electronic applications
5. Evaluate the design and control of AC power supplies and uninterruptable power supplies.

UNIT I
Modern power semiconductor devices:

Modern power semiconductor devices- MOS turn Off Thyristor (MTO) - Emitter Turn Off Thyristor (ETO) Integrated Gate- Commutated Thyristor (IGCTs)-MOS-controlled Thyristors (MCTs)-Static Induction circuit comparison of their features.

UNIT II
Resonant Pulse Inverters:

Resonant pulse inverters-series resonant inverters-series resonant inverters with unidirectional switches series resonant inverters with bidirectional Switches analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter-analysis of half bridge and full bridge resonant inverter with bidirectional switches.

UNIT III
Multilevel Inverters:

Multi level concept-Classification of multilevel inverters- Diode clamped multilevel inverter-principle of operation-main features improved diode - Clamped inverter-principle of operation-Flying capacitors multilevel inverter principle of operation-main features.
UNIT IV
DC Power Supplies:

DC power supplies-classification-switched mode dc power supplies-fly back Converter-forward
converter-push pull converter-half bridge converter-Full bridge converter-Resonant dc power
supplies-bidirectional dc power supplies-Applications.

UNIT V
AC Power Supplies:

AC power supplies classification-switched mode ac power supplies. Resonant AC power
supplies-bi directional ac power supplies-multi stage conversions-control circuits-applications.
Introduction-power line disturbances-power conditioners-uninterruptible Power supplies
applications.

TEXT BOOKS
   and Sons Second Edition.
ADVANCED CONTROL SYSTEMS

B. Tech. III Year II Semester

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

6. Understand mathematical preliminaries for advanced control systems.
7. Realize state variable models for linear time invariant systems.
8. Analyze Non linearities in control systems.
10. Assess optimal control for control problems.

UNIT-I
Mathematical Preliminaries:


UNIT-II
State Variable Analysis:


UNIT-III
Non Linear Systems:

UNIT-IV
Stability Analysis:


UNIT-V
Optimal Control:


TEXT BOOKS:
1. Modern Control System Theory by M.Gopal – New Age International -1984

REFERENCES:
1. Optimal control by Kirck, Dover Publications
Course Outcomes: At the end of the course, the student will be able to

1. Realize the need for energy auditing and conservation. Get awareness on types of energy audit; represent energy flows and energy consumption in tabular and graphical methods.
2. Understand and exploit energy saving opportunities in energy efficient motors and power factor improvement methods.
3. Learn energy auditing and conservation opportunities in energy efficient buildings.
4. Analyze economic viability with respect to real world problems using depreciation methods.
5. Examine the check lists for energy conservation in boilers, heat pumps, cooling systems, compressors and fans.

UNIT I
BASIC PRINCIPLES OF ENERGY AUDIT:


UNIT II
ENERGY EFFICIENT MOTORS, POWER FACTOR IMPROVEMENT & LIGHTING:

Energy efficient motors, factors affecting efficiency, variable speed, variable duty cycle systems, effect of Voltage variation on motors, motor energy audit. Power factor- methods of improvement, location of capacitors, Pf with nonlinear loads- Good Lighting system design and practice, lighting control, lighting energy audit.

UNIT III
ENERGY EFFICIENT BUILDINGS:

UNIT IV
ECONOMIC ASPECTS AND ANALYSIS:

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis-calculation of simple payback method, net present worth method-Applications of cycle costing analysis, return of investment.

UNIT V
ENERGY CONSERVATION OPPORTUNITIES:


TEXT BOOKS:
1. BEE Guide Books Volume 1 to Volume 4

REFERENCE BOOKS:
B. Tech. III Year II Semester

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

1. Understand terms and concepts of illumination.
2. Apply the concepts of different electric lamps and good lighting Practices for artificial lighting systems.
3. Classify the methods of electric heating and welding
4. Categorize the concepts of different electric traction systems and existing traction system in India.
5. Analyze the mechanics of train movement.

UNIT I
ILLUMINATION FUNDAMENTALS:
Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

UNIT II
VARIOUS ILLUMINATION METHODS:
Discharge lamps, MV and SV lamps- comparison between tungsten filament lamps and fluorescent tubes, Basic Principles of Light Control, Types and design of lighting and flood lighting. Energy efficient Lights.

UNIT III
ELECTRIC HEATING & WELDING:
Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric Welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. welding.

UNIT IV
ELECTRIC TRACTION - I:
System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, Methods of electric braking-plugging Rheostatic braking and regenerative braking.
UNIT V
ELECTRIC TRACTION – II:

Mechanics of train movement, Speed-time curves for different services- trapezoidal and quadrilateral speed time curves.

TEXT BOOKS:

REFERENCE BOOKS:
1. Utilization of electric energy, E. Openshaw Taylor, Orient Longman (P) Ltd.
3. Utilization of electric power, N. V. Suryanarayana, New Age International (P) Ltd.
CONTROL SYSTEMS AND SIMULATION LAB

B. Tech. III Year II Semester

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Examine the time response of second order systems, Synchros, and truth tables verification by PLC.
2. Design of AC servomotor and DC servomotor to find out their transfer function practically.
3. Design of DC motor, DC generator, and finding out their transfer function practically.
4. Analyze magnetic amplifier characteristics.
5. Explain stability analysis through bode, Nyquist and root locus plots using Simulation Software.

Any Ten of the following experiments are to be conducted

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple. Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servomotor.
5. Transfer function of DC motor.
6. Transfer function of DC Shunt generator.
7. Characteristics of magnetic amplifiers.
10. Linear system analysis (Time domain analysis, Error analysis).
11. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using simulation software.
12. State space model for classical transfer function- Verification using simulation software.
Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Examine the characteristics of SCR, MOSFET & IGBT, and analyze triggering circuits.
2. Analyze input and output characteristics of AC-DC converters.
3. Synthesize input and output characteristics of Cycloconverters.
4. Examine input and output characteristics of DC-DC Converters.
5. Design of converters and inverters using P-Spice software.

Any ten of the following experiments are required to be conducted.

1. Study of the characteristics of SCR, MOSFET & IGBT.
2. Gate Firing Circuits for SCRs (R- Triggering, RC Triggering & UJT Triggering).
5. DC Jones Chopper with R & RL Loads.
10. Simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
11. Simulation of resonant pulse commutation circuit and Buck Chopper.
12. Simulation of single phase Inverter with PWM control.
### R20 B.TECH FOURTH YEAR COURSE STRUCTURE

#### B. Tech. IV Year I Semester

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ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

B. Tech. IV Year I Semester

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

1. Understand all types of measuring instruments and error compensations.
2. Discuss the operation of DC Crompton potentiometer; compare the CT and PT with phasor diagram.
3. Describe the concepts of power and energy measurement by using wattmeter and energy meter.
4. Outline the concept of DC and AC bridges for the measurement of resistance, inductance & capacitance.
5. Analyze the concepts of transducers and cathode ray oscilloscopes.

UNIT I
INTRODUCTION TO MEASURING INSTRUMENTS:

Classification-deflection, control and damping torques- Ammeters and Voltmeters- PMMC and moving iron type instruments- expression for the deflecting torque and control torque- Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters, electrometer type and attracted disc type voltimeters.

UNIT II
POTENTIOMETERS & INSTRUMENT TRANSFORMERS:

Principle and operation of D.C. Crompton’s potentiometer - standardization, Measurement of unknown resistance, current and voltage. A.C. Potentiometers: polar and coordinate types, standardization and applications. CT and PT- Ratio and Phase angle errors (of CT only).

UNIT III
MEASUREMENT OF POWER & ENERGY:

Single phase dynamometer, LPF and UPF watt meters, Double element and three element dynamometer watt meter- expression for deflecting and control torques, extension of range of wattmeter using instrument transformers. Measurement of reactive power. Single phase induction type energy meter- driving and braking torques-errors and compensations, testing by phantom loading using RSS meter. Three phase energy meter- Maximum demand meters.
UNIT IV
D.C BRIDGES & A.C BRIDGES:

UNIT V
TRANSDUCERS & OSCILLOSCOPES:
TRANSDUCERS: Definition of transducer, classification of transducers, advantages of electrical transducers, characteristics and choice of transducers. Principle of operation of LVDT and capacitor transducers, LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermo-couples, Piezo-electric transducers, photo-voltaic, photo-conductive cells and photo-chodiodes.

OSCILLOSCOPES: Cathode Ray Oscilloscope (CRO)- Cathode Ray tube, time base generator, horizontal and vertical amplifiers and Lissajous Patterns.

TEXT BOOKS:
2. Electrical & electronic measurements and Instrumentation, R.K. Ralput, S.Chand & Company Ltd.

REFERENCE BOOKS:
2. Electrical and electronic measurements, G.K. Banerjee, PHI Learning Pvt. Ltd.
B. Tech. IV Year I Semester

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

1. Understand economic operation of power systems.
2. Analyze and compute optimal loading of generators for a particular load demand.
3. Develop mathematical models of turbines and governors.
4. Address load frequency control problem.
5. Explain how series and shunt compensation helps in reactive power control.

UNIT I
ECONOMIC OPERATION OF POWER SYSTEMS:


UNIT II
HYDROTHERMAL SCHEDULING:


UNIT III
MODELING:

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


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:

Load Frequency Controllers: 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:


TEXT BOOKS:

REFERENCE BOOKS:
3. Power system operation and control, Dr. K. Uma Rao, Wiley India Pvt. Ltd.
Course Outcomes: At the end of the course, the student will be able to

2. Explain the types of batteries and principles of operation of batteries.
3. Analyze the control techniques of Electric motors which are used in Electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Assess various modes of Hybrid vehicles for different conditions.

UNIT- I
ELECTRIC VEHICLES:

Introduction to Electric Vehicles - History of Electric and Hybrid Vehicles - Component's vehicle mechanics - Roadway fundamentals - vehicle kinetics - Dynamics of vehicle motion - Propulsion System Design.

UNIT -II
BATTERIES:


UNIT III
DC & AC ELECTRICAL MACHINES (Speed control Techniques):

Motor and Engine rating - Requirements - Speed control techniques of DC machines in Electric Vehicles - Speed control techniques of three phase A/c machines, Induction machines, Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV
ELECTRIC VEHICLE DRIVE TRAIN:

UNIT V

HYBRID ELECTRIC VEHICLES:


TEXT BOOKS:

REFERENCE BOOKS:

Vidya Jyothi Institute of Technology

An Autonomous Institution

Accredited by NAAC & NBA, Approved by AICTE, New Delhi 47th Regular 2007-2010
Course Outcomes: After completion of this course, the student will be able to

1. Understand the severity of power quality problems in distribution system
2. Illustrate the concept of transmission line reactive power compensation
3. Choose proper shunt compensators for reactive power compensation
4. Apply the control circuits of static series compensators for various functions
5. Classify combined compensators.

UNIT - I
POWER QUALITY PROBLEMS IN DISTRIBUTION SYSTEMS:


UNIT - II
TRANSMISSION LINES AND SERIES/SHUNT REACTIVE POWER COMPENSATION:


UNIT - III
STATIC SHUNT COMPENSATORS:

Objectives of shunt compensation, Methods of controllable VAR generation, Static Var Compensator, its characteristics, TCR, TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics.
UNIT- IV
STATIC SERIES COMPENSATORS:

Objectives of series compensator, variable impedance type of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control.

UNIT-V:
COMBINED COMPENSATORS:

Introduction to Unified Power Flow Controller, Basic operating principles, Conventional control capabilities, independent control of real and reactive power.

TEXT BOOKS:

REFERENCE BOOKS:
1. Power Quality, C.Sankaran, CRC Press
2. "Understanding FACTS—Concepts and Technology of Flexible AC Transmission Systems"
   Narain G.Honorani, Laszlo Gyugyi
Course Outcomes

At the end of the Course, the student will be able to

1. Understand the differences between the embedded system and general computing system identify the purpose of embedded systems.
2. Examine embedded systems using different memory devices and communications interfaces
3. Explain the communication/Synchronization issues with a view to choose the best RTOS
4. Understand the concepts of IoT
5. Design IoT devices for real time applications

UNIT I:
INTRODUCTION TO EMBEDDED SYSTEMS:


UNIT II:
TYPICAL EMBEDDED SYSTEM:

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT III:
RTOS & TASK COMMUNICATION:

RTOS: OS Basics-Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.
UNIT IV:
INTRODUCTION TO IOT AND ARCHITECTURE

Introduction, Characteristics, Physical design, Logical design, Evolution of IoT, enabling technologies, IoT Levels, Domain Specific IoTs, IoT and Machine to machine communication, Need for cloud in IoT.

UNIT V:
IOT COMMUNICATION PROTOCOLS AND IOT SYSTEMS USE CASES

IoT nodes, IoT Edge, 6LOWPAN, ipv4/ipv6, MQTT, COAP, Smart cities, smart homes, automotive, agriculture, Healthcare, Activity Monitoring, and Industrial IoT.

TEXT BOOKS:

REFERENCE BOOKS:
3. Internet of Things – From Research and Innovation to Market, Editors Ovidiu Vermesan, Peter Friess,
Course Outcomes: At the end of the Course, the student will be able to:

1. Understand the operation of power electronic converters and their control strategies.
2. Apply the vector control strategies for ac motor drives.
3. Examine the control of Synchronous Motor Drives.
4. Analyze the speed control of Permanent Magnet motors and Switched Reluctance Motors.
5. Distinguish the implementation of the control strategies using digital signal processors.

UNIT I
POWER CONVERTERS FOR AC DRIVES:

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H Bridge as a 4-Q drive.

UNIT II
INDUCTION MOTOR DRIVES:

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).

UNIT III
SYNCHRONOUS MOTOR DRIVES:

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.
UNIT - IV
PERMANENT MAGNET MOTOR DRIVES:

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams. Speed and torque control in BLDC and PMSM.

Switched Reluctance Motor Drives: Evolution of switched reluctance motors - various topologies for SRM drives, comparison, closed loop speed and torque control of SRM.

UNIT - V
DSP BASED MOTION CONTROL:

Use of DSPs in motion control, various DSPs available, and realization of some basic blocks in DSP for implementation of DSP based motion control.

TEXT BOOKS:

REFERENCE BOOKS:
Programmable Logic Controllers & SCADA

(Professional Elective-4)

B. Tech. IV Year I Semester

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Course Outcomes: At the end of this course, students will be able to
1. Understand the concepts of PLC.
2. Illustrate the fundamentals of PLC for electrical devices
3. Analyze the operation of counters
4. Apply Instructions in PLCs.
5. Investigate implementation of SCADA.

UNIT I:

Programmable Logic Controllers: Introduction, parts of PLC, principles of operation, modifying the operation, PLCs versus computers, PLC size and application.

PLC Hardware Components: The I/O section, discrete I/O modules, analog I/O modules, special I/O modules, I/O specifications, central processing unit (CPU), memory design, memory types, programming terminal devices, recording and retrieving data human machine interfaces (HMIs).

Basics of PLC programming: Processor memory organization, program scan, PLC programming languages, relay-type instructions, instruction addressing, branch instructions, internal relay instructions, programming examine if-closed and if-open instructions, entering the latter diagram.

UNIT II:

Developing fundamental PLC wiring diagrams and ladder logic programs: Electromagnetic control relays, contactors, motor starters, manually operated switches, mechanical operated switches, sensors, output control devices, seal-in circuits, latching relays, converting relay schematics into PLC ladder programs.

UNIT III:

Programming counters: Counter’s instructions, up-counter, down-counter, cascading counters, incremental encoder-counter applications, combining counter and timer functions.

Program control instructions: Master control reset instruction, jump instruction, subroutine functions, immediate input and immediate output instructions, forcing external I/O addresses, safety circuitry, fault routine, temporary end instruction, suspend instruction.
UNIT IV:

Data manipulation instructions: Data manipulation, data transfer operation, data compare instructions, data manipulation programs, numerical data I/O interfaces, closed-loop control.

Math instructions: Match instructions, addition instruction, subtraction instruction, multiplication instruction, division instruction, file arithmetic operations.

UNIT V:

Sequencer and shift register instructions: Mechanical sequencers, sequencer instructions, sequencer programs, bit shift registers, word shift operations.

Process control network system and SCADA: Types of processes, structure of control systems, ON/OFF control PID control, Motion control, data communications, supervisory control and data acquisition (SCADA).

TEXT BOOKS:


REFERENCE BOOKS:

2. Ladder logic programming fundamentals, A.J. Wright, 2nd edition, A8 Prominent publisher, 2020
Course Outcomes: At the end of the course, the student will be able to

1. Understand the features of Smart Grid.
2. Illustrate the smart grid architecture.
3. Explain tools and techniques for smart grid and Distribution systems.
4. Justify operation and importance of PMUs, WAMS.
5. Imagine control techniques for micro grid and smartgrid.

UNIT I
INTRODUCTION TO SMART GRID:

Introduction to Smart Grid - Working - definitions of Smart Grid and Associated Concepts - Smart Grid Functions - Traditional Power Grid and Smart Grid - New Technologies for Smart Grid - Advantages - Indian Smart Grid - Key Challenges for Smart Grid.

UNIT II
SMART GRID ARCHITECTURE:

Components and Architecture of Smart Grid Design - Review of the proposed architectures for Smart Grid, fundamental components of Smart Grid designs, Transmission Automation, Distribution Automation - Renewable energy Integration.

UNIT III
COMPUTATIONAL TECHNIQUES FOR SMART GRIDS:

Tools and Techniques for Smart Grid: Computational Techniques Static and Dynamic Optimization Techniques, Computational Intelligence Techniques, Evolutionary Algorithms and Artificial Intelligence techniques.

UNIT IV
COMMUNICATION TECHNOLOGIES AND SMART GRID:

Introduction to Communication Technology - Synchro-Phasor Measurement Units (PMUs) - Wide Area Measurement Systems (WAMS) - Introduction to Internet of Things (IOT) - Applications of IOT in Smart Grid.

UNIT V
CONTROL OF SMART POWER GRID SYSTEM:

Load Frequency Control (LFC) in Micro Grid System - Voltage Control in Micro Grid System - Reactive Power Control in Smart Grid, Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

REFERENCE BOOKS:
B. Tech. IV Year I Semester

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

1. Understand the components of electric vehicles and fundamentals of electric vehicles.
2. Demonstrate the types of batteries, fuel cells and its characteristics.
3. Understand the basic principles of electric motors which can be used in electric vehicles.
4. Apprehend the transmission of the drive system and the components of transmission.
5. Design and analyze the performance of hybrid vehicles.

UNIT I
ELECTRIC VEHICLES:


UNIT II BATTERIES:


UNIT III
DC & AC ELECTRICAL MACHINES (Basics Principle of Operation Only):

Motor and Engine rating - Requirements - DC machines - Three phase A/c machines - Induction machines - Permanent Magnet Machines, Switched Reluctance Machines.

UNIT IV
ELECTRIC VEHICLE DRIVE TRAIN:

UNIT V
HYBRID ELECTRIC VEHICLES:


TEXT BOOKS:

REFERENCE BOOKS:
ENERGY STORAGE SYSTEMS
(Open Elective – 3)

B. Tech. IV Year I Semester

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

1. Understand the concepts and roles of electrical energy storage technologies.
2. Analyze the needs for electric energy storage.
3. Identify the types of energy storage systems and various devices used for this purpose.
4. Evaluate the performance of electrical energy storage systems.
5. Apply the concepts of energy storage systems to real time problems.

UNIT I
ELECTRICAL ENERGY STORAGE TECHNOLOGIES:

Characteristics of electricity - The roles of Electric Energy Storage - High generation cost during peak demand periods - Need for continuous and flexible supply - long distance between generation and consumption- Congestion in power grids - Transmission by cables.

UNIT II
NEEDS FOR ELECTRICAL ENERGY STORAGE:

Emerging needs for Electric Energy Storage - Utilization of more renewable energy - less fossil fuel - Smart Grid uses - The roles of electrical energy storage technologies - The roles from the view point of a utility, from the view point of consumers, from the view point of generators of renewable energy.

UNIT III
FEATURES OF ENERGY STORAGE SYSTEMS:

Classification of Electric Energy Storage systems - Mechanical storage systems - Pumped Hydro Storage (PHS) - Compressed Air Energy Storage (CAES) - Flywheel Energy Storage (FES) - Electrochemical storage systems - Secondary batteries - Flow batteries - Chemical energy storage, - Hydrogen (H2) - Synthetic Natural Gas (SNG).
UNIT V
TYPES OF ELECTRICAL ENERGY STORAGE SYSTEMS:

- Electrical storage systems - Double-layer capacitors (DLC)
- Superconducting magnetic energy storage (SMES)
- Thermal storage systems

UNIT V
APPLICATIONS:

- Present status of applications - Utility use (conventional power generation, grid operation & service)
- Consumer use (uninterruptable power supply for large consumers)
- New trends in applications
- Renewable energy generation
- Smart Grid
- Smart Micro grid
- Smart House
- Electric vehicles
- Management and control hierarchy of storage systems
- Internal configuration of battery storage systems
- External connection of EES systems
- Aggregating EES systems and distributed generation (Virtual Power Plant)
- Battery SCADA

TEXT BOOKS:

1. Electrical energy storage, IEC Market Strategy Board.

REFERENCE BOOKS:


1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.
ELECTRICAL MEASUREMENTS LAB

B. Tech. IV Year I Semester

Course Outcomes: Upon the completion of Laboratory course, the student will be able to

1. Calibrate voltmeters, ammeters and single phase energy meter.
2. Design the scale of PMMC voltmeter, LPF wattmeter, LVDT and resistance strain gauge.
3. Calculate resistance, inductance and capacitance using bridges.
4. Compute 3-Q reactive power.
5. Test single phase energy meter and dielectric strength of oil of transformers.

Any ten of the following experiments are required to be conducted

2. Calibration of dynamometer type power factor meter.
3. Crompton D.C. Potentiometer - Calibration of PMMC ammeter and PMMC voltmeter.
5. Dielectric oil testing using H.T. testing Kit.
7. Measurement of 3 Phase reactive power with single-phase wattmeter.
9. LVDT and capacitance pickup - characteristics and Calibration.
11. Transformer turns ratio measurement using A.C. Bridge.
B. Tech. IV Year II Semester

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

1. Understand the importance of illumination and various illumination techniques.
2. Examine the performance of simple resistance furnaces, modern welding techniques.
3. Apply the concepts of Electrolytic process
4. Categorize different types of Electric Traction systems
5. Evaluate different types of traction mechanics

UNIT - I
ILLUMINATION


UNIT - II
ELECTRICAL HEATING & ELECTRIC WELDING


UNIT - III
ELECTROLYTIC PROCESS


UNIT - IV
ELECTRIC TRACTION

UNIT V
TRACTION MECHANICS


TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes: At the end of the course, the student will be able to

1. Discuss the energy scenario and the consequent growth of the power generation from renewable energy sources.
2. Explain the basic physics of wind and wind generation topologies.
3. Describe the basics of solar power generation.
4. Express the power electronic interfaces for solar PV generation.
5. Generalize the issues related to the grid-integration of solar and wind energy systems.

UNIT I
PHYSICS OF WIND POWER:

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

UNIT II
WIND GENERATOR TOPOLOGIES:


UNIT III
THE SOLAR RESOURCE:

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Solar thermal power generation:
Technologies - Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis
UNIT IV
SOLAR PHOTOVOLTAIC:

UNIT V
ENERGY STORAGE TECHNOLOGIES:
Role of Electrical Energy storage system - Electro chemical storage systems, secondary batteries, Management and control hierarchy of storage systems - Internal configuration of battery storage systems, design of electric energy storage system for solar and wind plants (block diagram).

TEXT BOOKS:

REFERENCE BOOKS:
1. Wind power in power systems, T. Ackermann, John Wiley and Sons Ltd., 2005.
Annexure – II
COURSE OUTCOMES:
At the end of the course the student should be able to
1. Understand the concept of network topology
2. Apply the concepts of the filters, attenuators to real-world problems.
3. Synthesize the electrical networks using different techniques.
4. Analyze the basic concepts of DC machines & AC Machines.
5. Assess concepts of some special machines.

UNIT I:
Network topology:
Definitions, Graph, Tree, Basic cutest and Basic Tie set Matrices for Planar Networks, Loop and Nodal methods for analysis of Networks with Dependent & Independent Voltage and Current Sources, Duality & Dual Networks.

UNIT II:
Filters and attenuators:
Filters:
Attenuators:
T-Type Attenuator, p-Type Attenuator, Bridged T-Type Attenuator, Lattice Attenuator.

UNIT III:
Network synthesis:
Reliability Concept, Hurwitz Property, Positive Realness, Properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions, Foster and Cauer forms.
UNIT IV:
DC generators and dc motors:
DC Generators:
Principle of Operation, EMF equation, Introduction to armature reaction and commutation, Types of Generators, Magnetization (OCC) characteristics - critical field resistance and critical speed, Applications.
DC Motors:
Principle of operation - Back E.M.F. - Torque equation, Types of DC Motors, Losses and Efficiency, Brake Test, Speed control of DC Motor - Flux and Armature Voltage control methods, Applications.

UNIT V:
Special machines:
Principles of operation of Reluctance Motors, Stepper Motors, Universal Motors, Permanent magnet Brushless DC Motors

TEXT BOOKS:

REFERENCE BOOKS:
CONTROL SYSTEMS ENGINEERING
(B.Tech. Electronics and Communication Engineering)

III B.Tech I semester

COURSE OUTCOMES:

At the end of the Course, the student will be able to:

1. Understand and analyzing different linear-time-invariant systems using transfer function.
2. Analyze system response in time domain for first and second order systems and evaluate static error.
3. Understand the concept of stability and its assessment for linear-time invariant systems.
4. Analyze system response in frequency domain and understanding compensation networks.
5. Realize the concept of state variable, state space and analyze the stability of linear Time discrete systems.

UNIT I:
Introduction to control Systems:
Concepts of control systems, open & closed loop control systems-examples, Industrial Control systems examples, Mathematical models of physical systems.
Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples- Block diagram algebra – Representation by signal flow graph- Reduction using Manson's gain formula

UNIT II:

UNIT III:
Stability analysis in S-Domain:
Root Locus technique: The root locus concept – construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT IV:
Frequency-response analysis:
UNIT V:
State space analysis:
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization-Solving the Time invariant state Equation- State Transition Matrix and its Properties-Concepts of Controllability and Observability.

TEXT BOOKS:
1. Nagoorkani A, Control Systems Engineering, CBS PUB & DIST, 2020

REFERENCE BOOKS:
Basic Electrical Engineering
(II B. Tech Mechanical Engineering)

Course Outcomes: At the end of the course, students will be able to:
1. Understand basic principles of electrical elements.
2. Apply the concepts of AC Circuits to various elements and combinations.
3. Examine Magnetic properties and principle of transformer.
4. Contrast the working of DC Machines and Induction Motors.
5. Assess working principle of AC generator and electrical installations.

UNIT I
INTRODUCTION TO ELECTRICAL ENGINEERING AND DC CIRCUITS

UNIT II
AC CIRCUITS
Representation of sinusoidal waveforms, peak, rms and average values. Elementary treatment of single-phase AC circuits consisting of R, R-L, R-C, R-L-C combinations (series and parallel). Phase representation, real power, reactive power, apparent power, resonance concept. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III
MAGNETIC CIRCUITS & TRANSFORMERS
TRANSFORMERS: Ideal and practical single phase transformer, OC-SC tests, equivalent circuit, losses in transformer, regulation and efficiency - simple problems.

UNTI IV
DC MACHINES AND INDUCTION MOTORS
THREE PHASE INDUCTION MOTOR
Construction, Principle and working of three phase Induction Motor, torque slip characteristics, simple problems.
SINGLE PHASE INDUCTION MOTOR
Single phase Induction Motor construction and working principle, capacitor start- applications.
UNIT V
AC GENERATOR & ELECTRICAL INSTALLATION

AC GENERATOR
Construction, Principle of operation of Synchronous Generator, Pitch Factor- Distribution Factor (or winding factor) - EMF equation – simple problems.

ELECTRICAL INSTALLATION
Fuse, Circuit breakers, difference between fuse and circuit breaker, Types of Batteries, battery backup.

TEXT BOOKS:

REFERENCE BOOKS:
1. Network Analysis by Sudhakar & Shyam Mohan.
BASIC ELECTRICAL ENGINEERING LABORATORY  
(W B.Tech Mechanical Engineering)  
B. Tech. Mechanical II Year II semester

Pre requisite: Basic Electrical Engineering

Course Outcomes: At the end of the course, students will be able to
1. Understand basic electrical laws.
2. Analyse the response of different types of electrical circuits to different excitations.
3. Apply electric laws and find out the performance of various electrical machines
4. Assess the losses in electrical machines

List of experiments/demonstrations:

Any 5 experiments from Part-A and Part-B should be conducted (Total 10 Experiments)

Part-A
1. Verification of Ohms law
2. Verification of KVL and KCL
3. Verification of Thevenin's Theorem
4. Verification of Superposition Theorem
5. Transient Response of Series R- L and R - C circuits using DC excitation
6. Determination and Verification of Impedance and Current of RL and RC series circuits

Part-B
1. Transient Response of R-L-C Series circuit using DC excitation
2. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
3. OC & SC Test on Single phase transformer
4. Brake test on DC shunt motor
5. Brake test on Three Phase Squirrel cage induction motor.
6. OCC of Three phase alternator.

REFERENCE BOOKS:
PRINCIPLES OF ELECTRICAL ENGINEERING
(B. Tech Civil Engineering)
Prerequisites: Mathematics, Physics

Course Outcomes: At the end of the course, students will be able to
1. Understand basic principles of electrical elements.
2. Apply the concepts of AC Circuits to various elements and combinations
3. Examine principle and operation of transformer
4. Contrast the working of DC Machines and Induction Motors.
5. Assess working of measuring instruments.

UNIT I
INTRODUCTION TO ELECTRICAL ENGINEERING
Ohm's law, basic circuit components, Kirchhoff's laws, simple problems.

NETWORK ANALYSIS
Basic definitions, types of elements, types of sources, resistive networks, inductive networks, capacitive networks, and series parallel circuits, star delta and delta star transformation. Network theorems- Superposition, Thevenin's, Maximum power transfer theorems and simple problems.

UNIT II
ALTERNATING QUANTITIES
Principle of ac voltages, waveforms and basic definitions, root mean square and average values of alternating currents and voltage, form factor and peak factor, phasor representation of alternating quantities, the J operator and phasor algebra, analysis of ac circuits with single basic network element, single phase series circuits.

UNIT III
TRANSFORMERS
Principles of operation, Constructional Details, Ideal Transformer and Practical Transformer, Losses, Transformer Test, Efficiency and Regulation Calculations (All the above topics are only elementary treatment and simple problems).

UNIT IV
D.C. MACHINES
D.C GENERATORS
Principle of operation of dc machines, types of D.C generators, EMF equation of D.C generator.
D.C MOTORS
Principle of operation of dc motors, types of D.C motors, torque equation, simple problems.
UNIT V
BASIC INSTRUMENTS
Introduction, classification of Instruments, operating principles, essential features of measuring instruments, Moving coil permanent magnet (PMMC) instruments, Moving Iron of Ammeters and Voltmeters (elementary Treatment only).

TEXT BOOKS:

REFERENCE BOOKS:
Annexure – III
For Students detained in R15 regulations and rejoined in R20 regulations (subjects in addition to the existing subjects of corresponding semesters) the following subjects are proposed as substitute subjects:

### Courses Offered to those who are Re-admitted in II-I Sem.

No courses

### Courses Offered to those who are Re-admitted in II-II Sem.

<table>
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<tr>
<th>S.No.</th>
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<th>Substitute Subjects</th>
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**PC:** Professional Communication

### Courses Offered for those who are Re-admitted in III-I Sem.

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**PC:** Professional Communication  
**GS:** Gender Sensitization  
**NMPD:** Numerical Methods and Partial Differential Equations  
**PEE:** Python for Electrical Engineers

### Courses Offered to those who are Re-admitted in III-II Sem.

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**PC:** Professional Communication  
**GS:** Gender Sensitization  
**NMPD:** Numerical Methods and Partial Differential Equations  
**PEE:** Python for Electrical Engineers

### Courses Offered to those who are Re-admitted in IV-I Sem

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**PC:** Professional Communication  
**ECN:** Essentials of Computer Networks  
**GS:** Gender Sensitization  
**NMPD:** Numerical Methods and Partial Differential Equations  
**MPID:** Microprocessors and Interfacing Devices  
**PEE:** Python for Electrical Engineers
Courses Offered to those who are Re-admitted in IV-II Sem

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PC: Professional Communication  
NMPD: Numerical Methods and Partial Differential Equations  
GS: Gender Sensitization  
PEE: Python for Electrical Engineers
For Students detained in R-18 regulations and rejoined in R20 Regulation (subjects in addition to the existing subjects of corresponding semesters)

Courses offered to those who are Re-admitted in II-I Sem.

No courses

Courses offered to those who are Re-admitted in II-II Sem.

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EDC: Electronics Devices and Circuits
PS-I: Power Systems I

Courses offered to those who are Re-admitted in III-I Sem.

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PS-II: Power Systems-II
PEE: Python for Electrical Engineers
STLD: Switching Theory and Logic Design

Courses offered to those who are Re-admitted in III-II Sem

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PEE: Python for Electrical Engineers
EECA: Electrical Energy Conservation and Auditing
PDBS: Personality Development and Behavioral Skills
QMLR: Quantitative Methods and Logical Reasoning

Courses offered to those who are Re-admitted in IV-I Sem

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ECN: Essential of Computer Networks
PE-I: Professional Elective I
PEE: Python for Electrical Engineers
### Courses offered to those who are Re-admitted in IV-II Sem

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**ECN**: Essential of Computer Networks  
**PE-1**: Professional Elective - 1  
**PE-4**: Professional Elective - 4  
**PEE**: Python for Electrical Engineers
For Students detained in R-19 regulations and rejoined in R20 Regulation (subjects in addition to the existing subjects of corresponding semesters)

Courses offered to those who are Re-admitted in II-I Sem

No courses

Courses offered to those who are Re-admitted in II-II Sem

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PC: Professional Communication
PS –I: Power Systems I
GS: Gender Sensitization

Courses offered to those who are Re-admitted in III-I Sem

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STLD: Switching Theory and Logic Design

Courses offered to those who are Re-admitted in III-II Sem

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PE-1: Professional Elective -1
PE-2: Professional Elective -2

PDBS: Personality Development and Behavioral Skills
QMLR: Quantitative Methods and Logical Reasoning

Courses offered to those who are Re-admitted in IV-I Sem

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PDBS: Personality Development and Behavioral Skills
PEE: Python for Electrical Engineers
ECN: Essentials in Computer Networks

PE-1: Professional Elective -1

Courses offered to those who are Re-admitted in IV-II Sem

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PEE: Python for Electrical Engineers
PE-1: Professional Elective -1
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**Courses offered to those who are Re-admitted in IV-II Sem**

- **PEE**: Python for Electrical Engineers
- **ECN**: Essentials in Computer Networks
- **PE-4**: Professional Elective - 4
- **PE-1**: Professional Elective - 1
- **ISP**: Introduction to Signal Processing