SOLAPUR UNIVERSITY, SOLAPUR.

FACULTY OF ENGINEERING &TECHNOLOGY

STRUCTURE OF B.E ELECTRICAL AND ELECTRONICS ENGINEERING

W.E.F. 2015-16

Semester- I

Sr No	Subject	Teaching Scheme			Examination Scheme				
		L	P	T	TH	TW	POE	OE	Total
1	Industrial drives and control	4	2	--	100	25	50	--	175
2	Electrical energy Utilization and Traction	4	--	--	100	25	--		125
3	Electrical Installation, testing & maintenance	4	2	---	100	25	--	--	125
4	Switchgear & Protection	4	2	--	100	25	--	50	175
5	Elective-I	4	--	--	100	25	--	--	125
6	Vocational Training	--	--	--	--	25	--	--	25
7	Project& Seminar	--	4	--	--	50	--	--	50
	Total	20	10	--	500	200	50	50	800

Semester- II

Sr No	Subject	Teaching Scheme			Examination Scheme				
		L	P	T	TH	TW	POE	OE	Total
1	HVDC &FACTS	4	2	---	100	25	--	50	175
2	Electrical Machine Design	4	2	1	100	25	---	50	175
3	Engineering Economics &Industrial Management	4	--	--	100	25	--		125
4	Elective –II	4	--	1	100	25	--	--	125
5	Project	---	8	---	---	100	---	100	200
	Total	16	12	2	400	200	--	200	800

Elective-I	**Elective-II**
1.High Voltage Engineering	1. EHVAC
2. Renewable Energy Sources	2.Energy conservation & Auditing
3.Digital Signal Processing	3.Data communication & Networking
4. PLC & Applications.	4. Power Quality
5. VLSI Design	5. Embedded System
6. Power System Dynamics &Stability	6. Modeling of electrical System

Note:

- Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 7, then a new batch shall be formed.
- Vocational Training (evaluated at B.E. Sem-I) of minimum 15 days shall be completed in any vacation after S.E. Sem-II but before B.E. Sem-I & the report shall be submitted and evaluated in B.E Sem-I
- Appropriate Elective I & II Subjects may be added when required.
- Project group for B.E Sem-I and Sem-II shall not be of more than **four** students.
- Term work assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

1. INDUSTRIAL DRIVES & CONTROL

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
POE: 50 Marks

Course Objectives:

1. To introduce electrical drives which are used for control the motion of motor.
2. To understand the basic knowledge of Characteristics of electrical drives and closed speed control schemes to students.
3. To understand Induction motor drive, Slip ring induction motor drive.
4. To understand about Synchronous motor drive, special drives such as Stepper motor drive, Brushless motor drive.

Course Outcomes: *The students will be able;*

1. To describe electrical drives which are used for control the motion of motor.
2. To explain the Characteristics of electrical drives and closed speed control schemes.
3. To explain and use Induction motor drive, Slip ring induction motor drive.
4. To describe Synchronous motor drive, special drives such as Stepper motor drive, Brushless motor drive.

SECTION-I

Unit 01: Introduction to Electrical drives (4Hrs)

Block diagram of electrical drives, Advantages of Electrical drives, Types of the electrical drives, parts of electrical drives, criteria for selection, selection of motor rating for various types of duty ratio, Recent trend in Drive & Industrial applications.

Unit 02: Dynamics of Electrical Drives (5Hrs)

Define Dynamics, factors for dynamics, effect of dynamics, Fundamental torque equation, speed, torque, multi-quadrant operation, classification of load torques. Steady state and transient stability of electric drives.

Unit 03: Characteristics & Control of Electrical Drives (5 Hrs)

Basic relations, Basic characteristics, Modified speed torque characteristics of D.C. Shunt and series motor, steady state characteristics of 3 phase induction motor, and synchronous motor, Closed loop control of drives- Current limit control, Closed loop torque control, Closed loop speed control, current sensing & speed sensing.

Unit 04: D.C. Motor Drives (10Hrs)

Methods of D.C. motor starting, braking and speed control, single phase and three phase full controlled and half controlled converter fed D.C. drives. Multi-quadrant operation of separately excited D.C. shunt motor, dual converter fed D.C. drives, converter control of D.C. series motor, Chopper controlled d. c. shunt motor drives, Single quadrant and multi-quadrant operation of D.C. shunt motor and Chopper control of series motor, performance and stability of variable speed D.C. drives Regenerative breaking the D.C. series motor.

SECTION-II

Unit 05: Induction Motor Drives (10Hrs)

Stator voltage control of 3 phase induction motor by A.C. regulator, VSI fed 3 phase induction motor speed control. Cyclo-convertor fed 3 phase induction motor speed control, variable frequency control by CSI, closed loop speed control, current regulated VSI control, comparison between VSI and CSI. Braking and multi quadrant operation of VSI controlled induction motor drives, single phase induction motor drive and its applications, Basics of harmonics in Induction motor.

Unit 06: Slip Ring Induction Motor Drives (4Hrs)

Chopper controlled resistance in rotor circuit, slip power recovery using Cascade converter, Static Sherbius drive, Static Krammer drive.

Unit 07: Synchronous motor and Brushless D.C. Motor Drives (4Hrs)

VSI fed synchronous motor drives, Variable frequency control of multiple Synchronous motor drives.

Unit 08: Special Drives (6Hrs)

Stepper motor drives, switched reluctance motor drives, Torque equation, converter circuit for motor, operation of solar and battery operated drives, Brush less D.C. Motor drives.

Term Work:

It should consist of minimum 8 experiments based on above syllabus the following list is given for reference.

List of Experiments:

1) Study of torque-speed characteristics of separately excited DC motor from single phase full converter.
2) Study of torque-speed characteristics of armature voltage controlled of separately excited DC motor from single phase full converter

3) Study of torque-speed characteristics of separately excited DC motor from three phase full converter
4) Study of torque-speed characteristics of DC series motor using chopper.
5) Three phase induction motor speed control using slip power recovery scheme.
6) *f to V* Control of induction motor.
7) Open loop speed control of separately excited DC motor using chopper at high frequency.
8) Three phase induction motor speed control using rotor resistance control
9) Simulation of chopper fed DC drive using MATLAB/SIMULINK.
10) Simulation of variable frequency induction motor drive using MATLAB/SIMULINK
11) Simulation of three phase converter fed separately excited DC motor control using MATLAB/SIMULINK.
12) Simulation of single phase converter fed separately excited DC motor control using MATLAB/SIMULINK.

Text Books:

1. Fundamentals of Electrical Drives. By Gopal. K. Dubey Narosa Publication
2. Analysis of Thyristor Power Controlled Motors By S.K. Pillai

Reference Books:

1. Power Electronics convertor application. By N. Mohan T.M. Udeland and W.P.Robbins John Willey & Sons
2. Electrical Drives-concept and application By Vedam Surya Vanshi
3. Advanced Power Electronics & A.C. Drives By B.K. Bose

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

2. ELECTRICAL ENERGY UTILIZATION AND TRACTION

Teaching Scheme:
Lectures: 4 Hours /Week
T.W.: 25 Marks

Examination Scheme:
Paper: 100 Marks

Course Objectives:

1. To impart the basic knowledge of some major applications which utilizes electrical energy
2. To understand performance analysis and mechanical design of Traction System.
3. To understand the Different type of electric vehicle.

Course Outcomes: *The students will be able;*

1. To design the lighting system as per the illumination required and area covered.
2. To describe various types of applications of electrical energy.
3. To select a suitable motor for EV/HEV applications.

SECTION-I

Unit 01: Illumination Engineering **(12Hrs)**

Basic terms in lighting systems, Laws of illumination, Polar curves, Photometry, Measurement of illumination, sources of light, study of different types of lamps ,types of luminaries , various factors related to luminaries selection, their control, and their features .Types of lighting systems, Recommended Illuminance levels for various tasks/activities locations.

Unit 02: Electric heating & Welding **(6Hrs)**

Basic working principle of Arc furnace, Induction furnace, Power supply requirement for furnaces, Electric welding equipment & power supply requirements.

Unit 03: Other applications of Electrical Energy **(6Hrs)**

Terminology, Refrigeration cycle, Vapor compression type, vapor absorption type, Electrical circuit of a Refrigerator, Room Air conditioner

SECTION-II

Unit 04: Systems of Traction (12Hrs)

Diesel Traction, Electric Traction, Various systems of Track Electrification like DC, single phase, Three phase & Composite system. Train Movement & Energy Consumption-Typical Speed /Time Curves, Mechanics of Train Movement, Power & Energy output from the driving axles, Specific Energy consumption, Factors affecting Specific Energy consumption, Dead weight, Accelerating weight and Adhesive weight.

Unit 05: Electric Traction Motors & Control (8 Hrs)

Suitability of DC/AC motors for traction purpose, Starting & speed control by using rheostat method, series parallel method, Thyristor control method. Power supply for electric traction - Current collection systems and related overhead equipment, substations - location & Distribution System, substation equipment, Traction SCADA & Signaling.

Unit 06: Electric Vehicle (EV) and Hybrid Electric Vehicles (HEV) (4 Hrs)

Architectures of hybrid EV/HEV power system, Energy Sources for EV /HEV applications, Type of motors used in EV/HEV and their comparison

Term Work:

It should consist of minimum 6 Assignment based on above syllabus .

Text Books:

1. Utilization of Electric Energy by J.B.Gupta, SK Kataria & Sons

2. Utilization of Electric Energy by R.K.Rajput, Laxmi Publications(P) Ltd

3. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhwa, Wiley Eastern Ltd

4. I. Hussein, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press, 2003.

Reference Books:

1. Art & Science of Utilization of Electric Energy by H.Partap, Dhanpat Rai & Sons

2. Electric Traction By H.Partap, Dhanpat Rai & sons

3. Designing with light-A Lighting Handbook By Anil Valia, Lighting System

4. Generation and Utilization of Electric Energy by S.Sivanagaraju, Pearson Education India

5. M. Ehsani, Y. Gao, S.E. Gay and Ali Emadi, *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press. 2005

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

3. ELECTRICAL INSTALLATION, TESTING & MAINTENANCE

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To provide sufficient knowledge of installation & testing of electrical equipments and switch-gears.
2. To understand various provision under IE rules.

Course Outcomes: *The students will be able;*

1. To take due care in the installation of electrical equipments observing IE rules.
2. To carry-out various testing methods for confirmation of the healthiness of electrical equipments.
3. To carry out various tests on CT / PT / breakers.

SECTION- I

Unit 01: Indian Electricity rules **(4 hrs)**

Indian Electricity rules, safely codes causes and prevention of accidents, artificial respiration, workmen's safety devices.

Unit 02: Transformers-I **(15 Hrs)**

Installation-Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection. Commissioning tests-Following tests as per national & International Standards, volt ratio test, earth resistance, oil strength, Bucholz & other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test.

Unit 03: Transformers-II **(5 Hrs)**

Specific Tests-Determination of performance curves like efficiency, regulation etc, and determinationof mechanical stress under normal &abnormal conditions.

SECTION-II

Unit 04: Synchronous Machines (8 Hrs)

Installation-Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out. Commissioning Tests- Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance. Performance tests-Various tests to estimate the performance of generator operations, slip test, maximum lagging current, maximum reluctance power tests, sudden short circuit tests, transient & sub transient parameters, measurements of sequence impedances, capacitive reactance, and separation of losses, temperature rise test, and retardation tests.

Unit 05: Induction Motors (8 Hrs)

Installation- Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling, fitting of pulleys & coupling, drying of windings. Commissioning Test-Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations &balancing. Electrical Tests-Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test, factory test and site test (in accordance with ISI code

Unit 06: CT / PT & Breaker (8 Hrs)

Standards, types, specification, installation, commissioning tests, maintenance schedule, type & routine tests.

Term Work:

Term Work should consist of two parts:

1) At least one visit to substation & transformer repair center should be arranged and the students should submit a report of the visit.
2) It should consist of minimum 8experiments based on above syllabus.
   The following list is given for reference.
   List of Experiments:
   1. Transformer testing- ratio test on various taps.
   2. Transformer testing- short circuit test on various taps.
   3. Transformer testing- measurement of magnetizing current on various taps & magnetic balance test from HV & LV side.
   4. Transformer testing-Winding resistance measurement on various taps.
   5. Transformer testing-vector group confirmation.
   6. Synchronous machines- Insulation, Resistance measurement of armature & field windings.
   7. Induction motors-Mechanical tests for alignment, air gap symmetry.
   8. Induction motors -Electrical Tests-Insulation test, earth resistance, routine test.

Text books:

1. Testing & Commissioning Of Electrical Equipment -S. Rao,Khanna Publishers,2004
2. Testing & Commissioning Of Electrical Equipment -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.

Reference books:

1. Relevant Bureau of Indian Standards
2. A Handbook on Operation and Maintenance of Transformers- H. N. S. Gowda, Published byH. N. S. Gowda,2006
3. Handbook of SwitchGears,BHEL, TMH,2005.
4. J and P Transformer Book,Elsevier Publication.
5. Preventive Maintenance of Electrical Apparatus : SK Sharotri, Katson Publishing House Ludhiana

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

4. SWITCHGEAR & PROTECTION

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
OE: 50 Mark

Course Objectives:

1. To introduce students with Principles of circuit breaking, important terms in switchgear, making and breaking capacity, fuse.
2. To give the basic knowledge of Medium and high tension switchgear, isolators, Earth blades.
3. To explain the students different types of relay based on microprocessor, Electromagnetic relay, static relay.
4. To explain the students causes of over voltages, over voltage protection schemes used in power system.

Course Outcomes: *The students will be able;*

1. To describe Principles of circuit breaking, important terms in switchgear, making and breaking capacity, fuse.
2. To explain basic knowledge of Medium and high tension switchgear, isolators, Earth blades.
3. To explain different types of relay based on microprocessor, Electromagnetic relay, static relay.
4. To implement overvoltage protection in electrical circuits.

SECTION-I

Unit 01: Principles of circuit breaking **(8 Hrs)**

Initiation of arc, arc extinction, DC and AC circuit breaking, arc voltage and current waveforms in an AC circuits, Definition of transient recovery Voltage, rate of rise of TRV, expression for TRV for different values of arc resistance, current chopping, Theories of arc extinction, arc control devices, Ratings and specifications of circuit breakers, making and breaking capacities, short circuit testing

Unit 02: Fuse **(6 Hrs)**

Introduction, definitions, Fuse characteristics, types of fuses, application of HRC fuse, selection of fuse, Discrimination.

Unit 03: Medium and high tension Switchgear (6 Hrs)

Principle of arc quenching in: Air Blast circuit Breaker (ABCB), Bulk oil circuit breaker (BOCB), Minimum oil circuit breaker (MOCB), Vacuum Circuit breaker (VCB), SF6 circuit breaker.

Unit 04: Isolator and Earth Blades (4 Hrs)

Types of Isolators, Voltage Capacity (manual and auto), Operations and Faults, Advantages, Purpose of earth Blades.

SECTION-II

Unit 05: Protective relaying (7 Hrs)

Need for protective system, Nature and causes of fault, Objective of protective relaying: Protective zones, Primary and backup protection, Desirable qualities Principle and characteristics of: Over current relays: Time setting, plug setting, IDMT relays, Directional relays, Distance relays resistance, reactance, impedance, MHO relays, Differential relays.

Unit 06: Protective static relay (7 Hrs)

Static over current relay, Advantages of static relay, Instantaneous over current relay, Definite time over current relay, Directional over current relay, Impedance relay, Reactance relay, MHO relay.

Unit 07: Protective Microprocessor based relay (5 Hrs)

Over current relay, Impedance relay, Directional relay, reactance relay, generalized mechanical expression for distance relay, measurement of R and X, MHO and offset MHO relay, quadrilateral relay.

Unit 08: Over voltage Protection (5 Hrs)

Causes of over-voltages, Overvoltage due to lightning, Arcing horn, Surge arrestor and absorbers, Metal oxide (Zno) arrestors, Insulation co-ordination in power system, Basic impulse insulation level.

Term work:

Term work shall consist of six practical/Drawing sheets and two assignments on the entire syllabus. The following list is given for reference.

List of Experiments:

1) Drawing sheet showing construction of MOCB, ABCB, SF6 CB and Vacuum CB.
2) Drawing sheet for Generator and transformer protection schemes.
3) Study of construction and working of induction disc type relays.
4) Plotting of I α t characteristics of an IDMT over current or E/F relay.
5) Experimental study of working of a Directional over current relay.
6) Experimental realization of microprocessor based over current relay.
7) Experimental realization of microprocessor based impedance relay.
8) Experimental realization of microprocessor based Directional over current relay.

Text Books*:*

1) Power System Protection and Switchgear: B.Ram and B.N. Vishwakarma
2) Switchgear and Protection: M.V. Deshpande

Reference books:

1) Switchgear and Protection: Sunil.S. Rao, Khanna Publications
2) Digital Protection: L.P.Singh
3) Electrical Power: J.B.Gupta.

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELECTIVE –I
5.1. HIGH VOLTAGE ENGINEERING

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand high-voltage phenomena and to present the basic of high-voltage insulation design and testing.
2. To understand the modern numerical tools available in high-voltage equipment design.

Course Outcomes: *The students will be able;*

1. To know the fundamentals properties of the materials and their failure mechanisms and appropriate optimal design.
2. To perform testing of different dielectric materials and the major requirements to develop HV Laboratories.
3. To design & set-up the high voltage lab.

SECTION-I

Unit 01: Electrostatic fields (6Hrs)
Electrostatic stresses, Gas/vacuum as insulators, liquid breakdown, solid breakdown, estimation and control of electric stresses, surge voltages, their distribution and control

Unit 02: Conduction and break-down in gases (6 Hrs)
Gases as insulating media, ionization processes, Town ends growth equation, primary and secondary process, Towns ends criterion for break-down, Pascens law, break-down in non-uniform fields and corona discharges, post break-down phenomena and applications, practical considerations in using gases for insulation purposes

Unit 03: Conduction and break-down in liquid dielectric (6Hrs)
Liquids as insulators, conduction and break-down in pure liquids, conduction and breakdown in commercial liquids

Unit 04: Break-down in solid dielectric (6Hrs)
Intrinsic break-down, electromechanical break-down, thermal break-down, breakdowns of solid dielectrics in practice, break-down of composite insulation, solid dielectric used in practice

SECTION-II

Unit 05: Generation of high voltages and currents (6Hrs)
Generation of HVDC/HVAC and impulse voltages, generation of impulse currents, tripping and control of impulse generators

Unit 06: Measurement of high voltage and currents (6 Hrs)
Measurement of high direct current voltages, measurement of high ac and impulse voltages, measurement of high dc, ac and impulse currents, CRO for impulse voltage and current

Unit 07: High voltage testing of electrical apparatus (6Hrs)
Testing of insulators and bushings, testing of circuit breakers, testing of cables, testing of transformers, testing of surge diverters, radio interference measurements

Unit 08: Design, planning and layout of high voltage laboratories (6Hrs)
Test facilities provided in high voltage laboratories, activity and studies in high voltage laboratories, classification of high voltage laboratories, size and ratings of high voltage laboratories, grounding of impulse testing laboratories

Term-work:-
It should consist of minimum 8 assignments based on above syllabus.

Text Books:

1. High Voltage Engineering by M S Naidu, V Kamraju Tata McGraw Hill publications New Delhi
2. High voltage insulation engineering by Ravindra Arora, Wolf Gang Mosch, New age international publishers ltd Wiley estern Ltd

Reference Books:

1. High Voltage Engineering by C L Wadhwa, New age international publishers ltd
2. Introduction to High Voltage Engineering Pearson 1970 Kuffel E and Abdullah M,

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELECTIVE –I
5.2. RENEWABLE ENERGY SOURCES

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand new paradigm of power generation in the form of renewable energy and the various means used for power processing and optimization.
2. To understand various energy storage technologies and their significance in the context of renewable energy based applications.

Course Outcomes: *The students will be able;*

1. To explain the basics of utilization of renewable energy sources, related power systems configurations and basics for futuristic power grid scenario.
2. To describe comparative study of the energy sources and an environment to get the utilization.

SECTION-I

Unit 01: Introduction to Energy Sources (4 Hrs)

Renewable and non-renewable energy sources, strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. India's Production and reserves, energy alternatives.

Unit 02: Solar Energy (6 Hrs)

Flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings.

Unit 03: Solar photovoltaic system (6 Hrs)

Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, solar photovoltaic system, Standards of solar photovoltaic system, Design and structure of PV modules, Applications of PV system, PV hybrid system.

Unit 04: Wind Energy **(8Hrs)**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: Economic issues, recent development.

SECTION-II

Unit 05: Energy from Biomass **(6 Hrs)**

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

Unit 06: Geothermal Energy **(3 Hrs)**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Unit 07: Energy from the ocean **(8 Hrs)**

Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

Unit 08: Hydrogen Energy& chemical energy **(3 Hrs)**

Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles, Basic Battery theory, Definition of fundamental quantities and characteristics, different types of batteries, different types of battery arrangements. Comparative study of all renewable energy sources on economical base.

Term-work:

It should consist of minimum 8 assignments based on above syllabus.

Text Books:

1. Rai G.D, "Non-Conventional energy Sources", Khanna Publishers.

2. R.K.Rajput "Non-Conventional energy Sources and utilization". Schand Publishers.

Reference Books:

1. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc Graw Hill.
2. Kothari D.P., "Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.
3. Ashok V. Desai, "Nonconventional Energy", New Age International Publishers Ltd.
4. S. Rao & B.B.Parulekar "Energy technology Nonconventional, Renewable and conventional", Khanna Publishers.

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELECTIVE –I
5.3. DIGITAL SIGNAL PROCESSING

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To examine the properties of DSP system.
2. To calculate Discrete Fourier Transform & verify its properties.
3. To understand design Analog and digital filters.

Course Outcomes: *The students will be able;*

1. To apply transform techniques for various applications.
2. To describe digital linear systems.
3. To Design filters for given applications.

SECTION – I

Unit 01: Introduction (5Hrs)

Introduction to DSP System, DT signals, co-relation of DT signals & its properties,

Unit 02: The Discrete Fourier transform and Fast Fourier Transform (10Hrs)

DFT, Relation between DFT and Z Transform, Properties of DFT, Circular convolution, Fast convolution techniques (Overlap add and overlap save), Frequency analysis of signals using DFT, FFT Algorithms (DIT FFT and DIF FFT)

Unit 03: Realization of Digital Linear systems (9Hrs)

Structures for realization of Discrete time systems, Structures for FIR Filters: Direct form, Cascade form. Structures for IIR filters: Direct form, Signal flow graph & transposed structure, cascade form and parallel form.

SECTION – II

Unit 04: IIR and FIR filters design (10 Hrs)

Impulse Invariant technique, Bilinear transformation, Analog Filter approximation (Butterworth), Linear phase FIR filter, Frequency sampling method of filter design, FIR filter design by Windows, Implementation of IIR filters & FIR filter.

Unit 05: Introduction to programmable Digital Signal Processors (8Hrs)

Basic Architectural features, multiply and accumulate (MAC) unit, Bus Architectures, VLIW Architecture, Special addressing modes, fixed point and Floating point Digital signal processors overview of TMS320C54XX DSP Architecture

Unit 06: Applications of DSP (6Hrs)

Applications of DSP in power systems: measurement of electrical quantities, Power system Protection etc. Applications of DSP for data compression, image processing, Control System.

Term-work:

It should consist of minimum 8 assignments based on above syllabus.

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications by John G Proakies Pearson Education.
2. Digital Signal Processing by Ramesh Babu -4th Edition Scientic Publication

Reference Books:

1. Digital Signal Processing – A Practical Approach by Ifeachor E.C. & Jervis B. W. -Pearson Education
2. Digital Signal Processing by S Salivahanan, A Vallavaraj & C Gnanapriya –TMH
3. Digital Signal Processors- Architecture, Programming and Applications by B Venkataramani & M. Bhaskar-TMH
4. Discrete time signal Processing by A.V. Oppenheim & R.W. Schalfer.- John Wiley

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELECTIVE –I
5.4. PLC AND APPLICATIONS

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand PLC system.
2. To understands Programming of PLC functionalities.
3. To Understands the SCADA systems and its utilization.

Course Outcomes: *The students will be able;*

1. To design the PLC system.
2. To program the PLC system.
3. To assess the problems in SCADA network.

SECTION-I

Unit 01: Introduction to PLC **(8Hrs)**

Definition & History of PLC, Overall PLC system, PLC Input & Output modules, central processing unit, CPUs & Programmer/monitors, Solid state memory, the processor, Input modules (Interfaces), Power supplies, PLC advantages & disadvantages. Selection criteria for PLC.

Unit 02: Programming of PLC **(8Hrs)**

Programming equipments, proper construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, and analysis of rungs. Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, programming ON/OFF Inputs to produce ON/OFF outputs.

Unit 03: Advanced PLC Function **(8Hrs)**

Analog PLC operation, PID control of continuous processes, simple closed loop systems, problems with simple closed loop systems, closed loop system using Proportional, Integral &Derivative (PID), PLC interface, and Industrial process example. Motors Controls: AC Motor

starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

SECTION-II

Unit 04: SCADA Systems (8Hrs)

Introduction and definitions of SCADA, Fundamental principles of modern SCADA systems, SCADA system evolution. Basic SCADA system Architecture: Human Machine Interface, Master Terminal Unit, Remote Terminal Unit. SCADA data transfer through PLC. Communication Technologies.

Unit 05: Communication system (6 Hrs)

Communication system components, SCADA Communication in an electrical power system. SCADA system desirable Properties, Real Time System, SCADA server, SCADA functions.

Unit 06: SCADA Architecture (10Hrs)

First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture, Intelligent Electronic Devices. Operation and control of interconnected power system, Automatic substation control, SCADA configuration, Energy management system, system operating states, system security, State estimation, SCADA system security issues overview. SCADA systems in the critical Infrastructure: Petroleum Refining Process, Conventional Electric Power Generation, water Purification System, Chemical Plant.

Term-work:

Term Work should consist of two parts:

1) It should consist of minimum 6 assignments based on above syllabus.
2) Compulsory visit to SCADA and PLC based automation industry & submit report of it as a term work.

Text Books:

1. Gary Dunning, “Introduction to Programmable Logic Controllers”, Thomson, 2nd Edition
2. Stuart A Boyer, “SCADA supervisory control and data acquisition”.
3. W. Bolton “PLC Programming”

Reference Books:

1. Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition
2. Gordan Clark, Deem Reynders, “Practical Modem SCADA Protocols”
3. Krishna Kant, “Computer Based Industrial Control”, PHI
4. John W. Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles and Application”, 5th Edition.

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELCTIVE -I
5.5. VLSI DESIGN

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To introduce the VLSI technology.
2. To design concepts, electrical properties.
3. To understand the modeling of Very Large Scale Integrated circuits.
4. To learn the concepts of modeling a digital system using Hardware Description Language.

Course Outcomes: *The students will be able;*

1. To develop VLSI design from VHDL programming for a system.
2. To select proper hardware for particular applications.
3. To design digital circuits in VHDL.
4. To develop modeling of Very Large Scale Integrated circuits.

SECTION-I

Unit 01: Overview of Digital Logic Circuits (8 Hrs)
combinational circuits: Decoders, Multiplexer, ALU, sequential circuits: latch, flip flop – RS, JK, D, T., shift registers in SISO, SIPO, PISO, PIPO models; Counters – synchronous, Asynchronous, Ring, Finite state machine (FSM): Moore, Mealy Machines, Lift controller.

Unit 02: VHDL Modeling and Design Flow (8 Hrs)
Introduction to VLSI: complete VLSI design flow (with reference to an EDA tool), IEEE Standards VHDL Terms – Entity, architecture, Schematic, Components, Configuration. Modeling types – Behavioral, data flow, & Structural with the help of digital functions like Multiplexer, Shift Register, counter, etc.

Unit 03: VHDL Programming (8Hrs)
sequential processing, concurrent Vs sequential statements, subprograms and packages, attributes, data types and data objects, Test benches, Synthesizable, and non synthesizable statements

SECTION-II

Unit 04: CMOS Logic Design (8 Hrs)
NAND, NOR structures, FAN IN, FAN OUT, Propagation Delay, Power dissipation and figure of merit , comparison of CMOS and NMOS

Unit 05: Programmable Logic Devices (PLDs) (8 Hrs)
PAL, PLA, CPLD, FPGA – Architectures of these devices with the help of XILINX

Unit 06: VLSI Design Applications (8Hrs)
Barrel shifter, signed and unsigned comparators, Carry ripple and carry look, Ahead address, Fixed- point division, serial data receiver, parallel to serial converter,

Term-work:
It should consist of minimum 8 assignments based on above syllabus.

Text Books:
1. Douglas Perry, "VHDL", Tata McGraw Hill
2. John F. Wakerly, "Digital Design, Principles and Practices", Prentice Hall Publication
3. Wolf, "Modern VLSI Design", Pearson Education

Reference Books:
1. Charles H. Roth, "Digital System Design Using VHDL", PWS Publishing Company (Thomson Learning)
2. J. Bhaskar, "VHDL Primer", 3rd Edition, Addison Wesley Longman Singapore Pte Ltd.
3. Volner A. Dedroni, "Circuit Design with VHDL", PHI Publications
4. Xilinx Data Manual "The Programmable Logic Data Book"

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

ELCTIVE -I

5.6. POWER SYSTEM DYNAMICS & STABILITY

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives

1. To understand various types of stability.
2. To understand various concept of stability.
3. To understand methods of maintaining stability.

Course Outcomes: *The students will be able;*

1. To explain various types of stability.
2. To describe the conditions of power flow and various methods to maintain reliable electric supply.
3. To evaluate integration techniques based on stability.

SECTION-I

Unit 01: Introduction to the power system stability (6 Hrs)
Basic concept and definitions- Rotor angle stability, voltage stability & voltage collapse, mid-term and long-term stability. Classification of stability, Historical review of stability problems.

Unit 02: Small- signal stability (10 Hrs)
Fundamental concepts of stability of dynamic systems- state space representation, stability of a dynamic system, linearization, analysis of stability. Eigen properties of the matrix- eigen values, eigenvectors, modal matrices, free motion of a dynamic system, mode shape, sensitivity, and participation factor, controllability and observability. Small-signal stability of a single-machine infinite bus system, effect of excitation system, power system stabilizer.

Unit 03: Transient Stability (8 Hrs)
An elementary view of transient stability, Numerical integration methods- euler method, modified euler method, runge-kutta (R-K) methods, numerical stability of explicit integration methods, implicit integration methods. Simulation of power system dynamic response- Structure of power system model, synchronous machine representation, excitation machine representation, transmission network and load representation.

SECTION-II

Unit 04: Voltage Stability (10 Hrs)

Basic concept related to voltage stability- transmission system characteristics, generator characteristics, load characteristics, characteristics of reactive compensation devices. Voltage collapse- typical scenario of voltage collapse, general characterization based on actual incidents, classification of voltage stability. Voltage stability analysis- modeling requirements, dynamic analysis, static analysis, determination of shortest distance to instability. Prevention of voltage collapse.

Unit 05: Subsynchronous Oscillation (8 Hrs)

Turbine-genrator torsional characteristics-shaft system model, torsional natural frequencies and mode shapes. Torsional interaction in power system controls- interaction with generator excitation controls, interaction with speed governors, interaction with dc converters. Subsynchronous resonance- Characteristics of series capacitor compensated transmission system, self excitation due to induction generator effect. Impact of network-switching disturbances, Torsional interaction between closely coupled units,

Unit 06: Mid-term & long-term Stability (6 Hrs)

Nature of system response to severe upsets, distinction between long term and midterm stability, power plant response during upsets-thermal power plants, hydro power plants. Simulation of long term dynamic response-purpose of long term dynamic simulations, modeling requirements, numerical integration techniques.

Term-work:

It should consist of minimum 8 assignments based on above syllabus.

Text Books:-

1. Power system stability & Control by Prabha Kundur,TATA McGRAW HILL Publications.
2. Power System Dynamics – Stability & Control, K. R. Padiyar, BS Publications

Refrence Books:-

1. I.J. Nagrath and M. Gopal, Control system engineering, Wiley Eastern Ltd, 3rd edition, 2000.
2. Benjamin C. Kuo, Automatic Control system, Prentice Hall of India Pvt Ltd.

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

6. VOCATIONAL TRAINING

Examination Scheme:
T.W.: 25 Marks

Evaluation is based on following two reports submitted by students

1) Students should attend the industrial training of 15 days and submit the training report.
2) Students must attend / visit any EHV substation and submit the visit report along with layout of the visited substation compulsory.
3) The term work marks should be based on following.
   i. Presentation on visit report
   ii. Report quality
   iii. Knowledge gained by students

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-I)

7. PROJECT & SEMINAR

Teaching Scheme:
Practical: 4 Hours/Week

Examination Scheme:
T.W.: 50 Marks

Guidelines: -

1) Each project group should consist of maximum 4 students.
2) Project topic should be hardware based or combination of hardware and software.
3) The group should submit a synopsis of the project to the department/guide.
4) The group should start the work and complete at least theoretical design of project in this semester.
5) At least one student from the group should deliver seminar on project topic & others can present any advanced topics in the relevant area.
6) Students should prepare & submit project report (Part-I) based on project design completed & seminar topics delivered by each students. Report must be hard bound.
7) The term work marks should be based on performance in seminar delivered, project work completed & report quality (neatness & contents).
8) Project group should meet guide every week & maintain record in project diary to record weekly progress of work done & to be signed by the guide.

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

1. HVDC&FACTS

Teaching Scheme:
Lectures: 4 Hours /Week
Practicals: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 50 Marks

Course Objectives:

1. To understand the problems in high voltage AC transmission system.
2. To get the knowledge of static devices under FACTS
3. To understand the configuration and working of HVDC system.

Course Outcomes: *The students will be able;*

1. To explain various controls used under FACTS.
2. To describe HVDC system and its practical application.

SECTION-I

Unit 01: FACTS Concepts and General System Consideration (6 Hrs)
Introduction of the facts devices, its importance's in transmission Network, Power flow in AC System, Basic types of FACTS controller, Brief Description and Definition of FACTS controller

Unit 02: Static Shunt Compensator (SVC AND STATCOM) (14Hrs)
Objectives of the shunt compensation, method of controller Var generation, static var compensators: SVC and STATCOM, Comparison between STATCOM and SVC

Unit 03: Static Series Compensator (GCSC, TSSC& SSSC) (4 Hrs)
Objectives of the series compensation, variable impedance type series compensation, switching converter type series compensators, chrematistics of series compensator

SECTION-II

Unit 04: DC power transmission technology (9Hrs)
Introduction, comparison of AC & DC transmission- economics of power transmission, technical performance, reliability. Application of DC transmission, Description of DC transmission system- types of DC links, converter station, Planning for HVDC transmission, Modern trends in

HVDC technology, some operating problems, HVDC transmission based on voltage source convertes.

Unit 05: Analysis of HVDC converters (6Hrs)

Introduction, Analysis of line commutated converter, Lcc bridge characteristics, characteristics of a twelve pulse converter, detailed analysis of converters, capacitor commutated converter, analysis of a voltage source converter.

Unit 06: Grid Control and Characteristics (9Hrs)

Grid control of thyristor, valve-Analysis with grid control with no overlap, overlap less than 60 degrees and overlap greater than 60 degrees. Basic means of control, Power reversal, manual control and its limitations-constant current versus constant voltage, desired features of control, actual control characteristics-constant minimum ignition angle, current and extinction angle controls – stability of control, power control and current limits.

Term work:

Term work shall consist of minimum four drawing sheets & four assignments based on above syllabus.

Text Books*:*

1. Understanding FACTS-Concepts and Technology of FACTS by Narain G. Hingorani, Laszlo Gyugyi, Standard Publishers.
2. FACTS Controller in Power Transmission and Distribution by K R Padiyar
3. HVDC power transmission systems 2nd Revised ED. by K R Padiyar, New Age International Publishers.

Reference Book:

1. Static Reactive power compensation By T.J.E. Miller, Jhonwiley& sons Newyork.
2. Padiyar K. R., "HVDC Transmission systems" , 1st ED. Wiley Eastern Ltd. 1991.
3. Kimbark E. W. "HVDC Transmision, 1st ED. Wiley Eastern Ltd
4. Power Transmission by Direct Current : E. Usdimann Springer Verlag, Berlin Edn. 1975.
5. EHVAC and HVDC Transmission: S.S. RaoKhanna Pub. Delhi.

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

2. ELECTRICAL MACHINE DESIGN

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week
Tutorial: 1 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
OE: 50 Marks

Course Objectives:

1. To impart knowledge of various aspects of Electrical Machine Design and make them aware of recent trends in design.
2. To understand determination of parameters & design of transformer.
3. To understand determination of parameters & design of Induction motor.
4. To understand determination of parameters & design of synchronous machine.

Course Outcomes: *The students will be able;*

1. To relate the physical dimensions of different parts of the machine to the rating.
2. To expose the optimization in design.
3. To analyze different parameter of transformer, Induction motor, Synchronous generator design.

SECTION-I

Unit 01: Introduction (5 Hrs)

Introduction to machine design, Magnetic, Electrical, Conducting and Insulating materials used in machines. Modes of heat dissipation. Calculation of short time and continuous rating of electrical machine.

Unit 02: Performance measurement of Transformers (7 Hrs)

Types and constructional features of core and windings used in transformer. Transformer auxiliaries such as tap changer, pressure release valve, breather and conservator. Calculation of mechanical forces developed under short circuit conditions, measures to overcome this effect. No load current, losses, efficiency and regulation of transformers.

Unit 03: Design of transformers (12 Hrs)

Output equation with usual notations, Main Dimensions, Specific electric and magnetic loadings, Design of core, Design of yoke, Selection of the type of winding, Design of LV and HV windings, Design of insulation, Cooling of transformers – design of cooling tank and tubes/ radiators. Operating characteristics of transformer.

SECTION-II

Unit 04: Performance measurement of three phase Induction motor (5 Hrs)

Calculation of leakage reactance, Carter's coefficients, Concept of B_{60}, Calculation of No load current, leakage reactance, Short circuit current, Calculation of maximum output from Circle diagram, Dispersion coefficient.

Unit 05: Design of three phase Induction motor (9 Hrs)

Output equation with usual notation, Choice of specific electric and magnetic loadings, Standard frames, Main dimensions, Design of stator and rotor windings, Stator and rotor slots, Design of stator core, air gap, Design of squirrel cage rotor, end rings, Design of wound rotor, MMF Calculation for air gap, stator teeth, stator core, rotor teeth and rotor core, effect of saturation.

Unit 06: Design of Synchronous machine (10 Hrs)

Review of construction of salient and non-salient pole alternators, Choice of electric & magnetic loadings, Output equation, Determinate of diameter & length, Length of air- gap & main Dimensions, effect of short circuit ratio on machine performance, Rotor design. Design of salient pole rotor, Sectional area & type of pole, pole height, damper winding, Design of field winding, Direct & quadrature axis synchronous reactance, MMF for magnetic circuit, Estimating full load field mmf, Design of turbo-generator, Estimation of length of air-gap.

Term work:

Term Work should consist of two parts:

1) It should consist of following six drawing sheets with report based on above syllabus.

   i. Types of winding used in transformer
   ii. Design of Yoke & Core of transformer
   iii. Design of Cooling tubes & Cooling methods
   iv. Design of Transformer
   v. Design of 3 phase Induction motor
   vi. Design of Synchronous generator.

2) Compulsory visit to Transformer and Induction motor manufacturing industry & submit report of it as a term work.

Text Books:

1. M.G. Say – Theory and Performance and Design of A.C. Machines, 3rd Edition, ELBS London.
2. A.K. Sawhney – A Course in Electrical Machine Design' 10th Edition, - Dhanpat Rai and sons New Delhi.
3. K. G. Upadhyay - Design of Electrical Machines, New age publication.

Reference Books:

1. K.L. Narang, A Text Book of Electrical Engineering Drawings, Reprint Edition: 1993 / 94 - Satya Prakashan, New Delhi.
2. A Shanmuga sundaram, G. Gangadharan, R. Palani, - Electrical Machine Design Data Book, 3rd Edition, 3rd Reprint 1988 - Willey Eastern Ltd., - New Delhi.
3. Vishnu Murti, "Computer Aided Design for Electrical Machines", B.S. Publications.
4. Bharat Heavy Electricals Limited, Transformers - TMH.

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

3. ENGINEERING ECONOMICS & INDUSTRIAL MANAGEMENT

Teaching Scheme:
Lectures: 4 Hours /Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To introduce the concept of Engineering Economics and its basics.
2. To understand the Industrial project and its implementation.
3. To introduce the concepts of Entrepreneurship and all types of industries.

Course Outcomes: *The students will be able;*

1. To handle the Industrial Projects effectively and efficiently.
2. To describe in detail the Industrial economical concepts.
3. To explain in detail functions of management and also concepts of Entrepreneurship.

SECTION-I

Unit 01: Engineering Economics **(10 Hrs)**
Basics of Economics, Economics applied to industries, Payback period, Value Engineering, Make& Buy decisions, Economic lot batch size, cost control & cost ratio, Introduction to Engineering Economics, Time value of Money, Cash Flows, Taxation Concepts, Tools for Engineering Economics.

Unit 02: Business Organization **(7 Hrs)**
Forms/Types of Business organizations, Proprietorship, Partnership, Private & Public Joint stock company, Organization structure & Characteristics, Line & Staff

Unit 03: Indian Economy **(7 Hrs)**
Infrastructure in Indian Economy, Energy, power, Science & Technology, sector comparative study of five year plans of Indian Economy for electrical sector

SECTION-II

Unit 04: Management **(10 Hrs)**
Functions of Management, Planning, organizing, staffing, directing, controlling. Human Resource Management: Concept, Objective and Functions of HRM, Principles of good HR policy, Incentives: types and characteristics. Management Information systems (MIS).

Preparation of Project:project planning & acquisition, characteristics of project, project proposal process, project planning Tools, Identification of Business Opportunities - Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study &Social Feasibility Study.

Unit 05: SSI & Entrepreneurship **(10 Hrs)**

Small Scale Industries: Definition of SSI, Classification, Advantages, Industrial Policies, Steps and procedure for setting SSI, facilities to SSI Entrepreneurship: definition, types, functions and qualities. Entrepreneurial Vs managerial Style, Locations and layout, phases in industrial project.

Unit 06: Industrial Acts & Safety **(4 Hrs)**

Indian Factory Act, The Indian Electricity Acts and rules, Industrial Safety

Term-work:

It should consist of minimum 8 assignments based on above syllabus.

Text Books:-

1. Industrial Organization & Engg. Economics by T.R.Banga, S.C.Sharma (Khanna Publishers)
2. Industrial Engg& Management by O.P. Khanna, Dhanpatrai& Co, 9th edition
3.Entrepreneurship Development - Small Business Enterprises - Poornima M Charantimath – Pearson Education – 2006.

Reference Book:-

1. Indian Economy By Ruddar Datt, K.P.M. Sundharum (S.Chand Publishers)
2. Managing Engg. & Technology - Daniel Babcock, PHI, 3rd Edition
3. The Electricity Rules, 2005 Professional Book Publishers, 2008-Edition

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.1. EHVAC

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hour/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand importance of insulation coordination.
2. To become aware of the necessity of EHVAC Transmission and appreciate its power handling capacity and major problems like Corona, High Electrostatic Fields, and Power Frequency voltage control.

Course Outcomes: *The students will be able;*

1. To explain the Corona, Electric shock Currents, the procedure for protection of extra high voltage and current.
2. To describe the insulators, transformers and the procedure for controlling of voltage using power frequency.

SECTION-I

Unit 01: Introduction and calculation of line and ground parameters (8Hrs)

Engineering aspects and growth of EHVAC, transmission line trends and preliminaries, power transferability, transient stability, transit stability limits, surge impedance loading, resistance, power loss, temperature rise properties of bundled conductors, inductance and capacitance, calculation of sequence and capacitance, line parameters for modes of propagation resistance and inductance of ground return.

Unit 02: Voltage gradient of conductors and I^2R and corona loss (9Hrs)

Charge potential relations for multi-conductor lines, surge voltage gradients on the conductor lines, surge voltage gradients on sub-conductors of bundle conductors, distribution of voltage gradients on sub-conductors of bundle, I^2R and corona loss, corona loss formula, charge voltage diagram with corona, attenuation of travelling waves due to corona loss, audible noise, corona pulses, their generation and properties.

Unit 03: Theory of travelling waves and standing waves (7Hrs)

The wave at the power frequencies, differential and solution for general case, standing waves and natural frequencies, open ended line double exponential response, response to sinusoidal, excitation, line energization with trapped charge voltage, reflection and refraction of travelling waves.

SECTION-II

Unit 04: Lighting and lighting protections (6Hrs)

Lighting strokes to lines, their mechanism, general principles of the lighting protections, problems, lower footing, resistance, lighting arrestors and protection characteristics, different arrestors and their characteristics, protection characteristic.

Unit 05: Over voltage in EHV system covered by switching operations (7Hrs)

Over voltage, their types, recovery voltage and circuit breaks, Ferro-resonance over voltage and calculation of switching, switching surges, single phase equivalents.

Unit 06: Power frequency voltage control and over voltages (7Hrs)

Generalized constants, charging currents, power circle diagram and its use, voltage control shunt and series component, sub-synchronous resonance in series capacitors compensated lines and static reactive compensating systems.

Unit 07: Insulation co-ordination (4Hrs)

Insulation levels, voltage withstand levels of protected equipments and insulation condition based on the lighting.

Term-work

It should consist of minimum 8 tutorials based on above syllabus.

Text Books:-

1. "High voltage engineering" Tata McGraw Hill publishing company-1982 Naidu M S And Kamraju V.
2. "High voltage engineering" Khanna publishers New Delhi. Radzeving D K.

Reference Book:-

1. "High voltage technology" Oxford university press, 1968 Alston L L.
2. " Travelling waves in transmission systems" John Wiley Dover 1963 Bewley L V.
3. Transient performance of electric power system. McGraw Hill book co.-1950 Rudenberg R.

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.2. ENERGY CONSERVATION & AUDITING

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hour/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand the basic knowledge of designing electrical distribution network.
2. To understand the basic knowledge of energy audit in the distribution system.

Course Outcomes: *The students will be able;*

1. To explain the energy scenario and various Acts of Energy Conservation.
2. To describe procedure of energy auditing.
3. To design the electrical distribution network.

SECTION-I

Unit 01: Energy Scenario (6Hrs)

Commercial and Non – commercial energy, primary energy resources, commercial energy production, final energy consumption, Indian energy scenario, Sectoral energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Unit 02: Energy Conservation Act 2001 and related policies (6Hrs)

Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change.

Unit 03: Basics of Energy and its various forms (6Hrs)

Electricity basics – Direct Current and Alternative Currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature and pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity and heat transfer, units and conversion, Metric Ton Oil Equivalent conversions.

Unit 04: Energy Management & Audit (6Hrs)

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 and energy substitution, energy audit instruments and metering, precautions, thermography, smart metering.

SECTION-II

Unit 05: Energy Action Planning (6Hrs)

Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing – location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Human resource development techniques, Information system – designing barriers, strategies; Marketing and communicating – training and planning.

Unit 06: Financial Management (6Hrs)

Investment-need, appraisal and criteria, financial analysis techniques – simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs).

Unit 07: Project Management (6Hrs)

Definition and scope of project, technical design, financing, contracting, implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification.

Unit 08: Energy Monitoring and Targeting (6Hrs)

Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques ,energy consumption, production, cumulative sum of differences(CUSUM). Energy Management Information Systems (EMIS)

Term Work:

It should consist of minimum 8 tutorials based on above syllabus.

Text Books:-

1. Utilization of Electrical Energy by S.C. Tripathi
2. Generation of Electrical Energy by B.R. Gupta, S Chand, 1st Edition

Reference Book:-

1. Energy Management by Murphy
2. Bureau of energy efficiency by Shikha Arora, Professional book publishers.
3. Preparatory course material for Energy auditor & manager. Govt of India NewDelhi.

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.3. DATA COMMUNICATION AND NETWORKING

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To build the idea of multiple layers in the data communication and the addressing mechanism between the different layers of OSI Reference Model.
2. To introduce with client-server paradigm for socket interfaces to discuss the client-server communication using connectionless & connection-oriented services offered by the transport layer protocols.
3. To study the architecture of WWW, HTTP, E-Mail & describe the concepts of Hypertext, hypermedia, web clients, web servers and their components to define URL, different Web documents in the application layer.

Course Outcomes: *The students will be able;*

1. To describe the purpose of different layers.
2. To write application layer protocols using services offered by the transport layer protocols such as UDP, TCP & SCTP.
3. To show the functioning of web based mail system and web services working mechanism.

SECTION – I

Unit 01: Data Link Layer **(8Hrs)**
DLL design issues, Error detection & correction, Elementary DLL protocols, Sliding window protocols.

Unit 02: Network Layer **(9Hrs)**
Network layer design issues, Routing algorithms: shortest path routing, flooding, flow-based routing, distance vector routing, link state routing, hierarchical routing, Congestion control algorithms, Internet work

Unit 03: Network layer in the Internet **(7Hrs)**
IP protocol, IP addresses, Subnet, Internet Control protocols, ARP, RARP, OSPF, BGP.

SECTION – II

Unit 04: Overview of TCP/IP Protocol Suite (4Hrs)

TCP/IP Protocol Suite: Comparison between OSI & TCP/IP Protocol Suite, Layers in the TCP/IP Protocol Suite, Addressing: Physical, Logical, Port & Application Specific Addresses

Unit 05: Transport Layer (12Hrs)

UDP: Overview of the OSI Model and the TCP/IP Protocol Suite, UDP: Introduction, User Datagram, UDP Services, UDP Applications, UDP Package, **TCP:** TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Window in TCP, Flow Control, Error Control, Congestion Control, TCP Timers, TCP Package **SCTP:** Stream Control Transmission Protocol: Introduction, SCTP Services, SCTP Features, Packet Format, An SCTP Association, State Transition Diagram

Unit 06: Client Server Model and Socket Interface (8Hrs)

Client Server Paradigm: Server, Client, Concurrency, Concurrency in Clients, Concurrency in Servers, Socket, Byte Ordering Functions, Address Transformation Functions, Memory Management Functions, Socket System Calls, Connectionless Iterative Server, UDP Client Server Programs, Connection-oriented Concurrent Server, TCP Client Server Program

Term work:

Term work shall consist of minimum eight tutorials based on above syllabus

Text Books:

1. Data & Computer Communication William Stallings. (seventh edition) PHI publications.
2. Computer Networks Andrew S. Tanenbaum (third edition) PHI publications.
3. TCP/IP Protocol Suite: Behrouz A. Forouzan (Fourth Edition)

Reference Books:

1. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer
2. Data and Computer Communications: William Stallings
3. Data Communication and Networking: Behrouz A. Forouzan

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.4. POWER QUALITY

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To get awareness of non-linear loads in power system.
2. To understand the affects power quality because non-linear loads.
3. To study the solution to improve power quality.

Course Outcomes: *The students will be able;*

1. To analyze the problems due to non-linear load and suggest solution for the same.
2. To explain Power quality standards.
3. To explain Harmonic mitigation techniques.

SECTION-I

Unit 01: Introduction (6 Hrs)
Understanding Power quality, Definitions, Growing concerns to PQ, Evaluation procedure, General Classes of PQ disturbances, Causes and effects of power quality disturbances. Unbalance, Distortion, Voltage Fluctuations, Flicker, Quality Assessment.

Unit 02: Harmonics (10 Hrs)
Definition of harmonics, odd and even harmonics, Harmonic phase rotation and phase angle Relationship, Causes of voltage and current harmonics, non-sinusoidal voltage and current Waveform equations (numerical included), individual and total harmonic distortion with Problems, Power assessment under waveform distortion with numerical.

Unit 03: Power Quality monitoring & standards (8Hrs)
Introduction, transducers current transformers, voltage transformers, Power quality Instrumentation, Harmonic monitoring, Power quality standards IEEE 519.

SECTION-II

Unit 04: Effects of harmonics (6 Hrs)

Rotating Machines, Transformers, Cables, Capacitors, Harmonic resonance, Voltage Notching, EMI (Electromagnetic Interference), Overloading of Neutral conductor, Protective relays and Meters.

Unit 05: PF and its improvement under sinusoidal and non-sinusoidal conditions (10 Hrs)

Power factor when both voltage and current sinusoidal, Power factor compensation using Capacitor (vector diagram and numerical included), power factor when voltage is sinusoidal and Current is non-sinusoidal (numerical included), Effect of capacitor compensation in power factor Improvement under non-sinusoidal condition.

Unit 06: Harmonic mitigation and power factor improvement (8 Hrs)

Mitigation of harmonics- Passive filters- Advantages and disadvantages of passive filters- Active Filters-shunt connection, series connection and hybrid connection (Detailed diagram with Inverters and its working), Power factor improvement using shunt active filter (both reactive Power and harmonic power compensation), Generating reference currents for shunt active filter Using Instantaneous PQ Theory.

Term work:

Term work shall consist of minimum eight tutorials based on above syllabus

Text Books*:*

1. "Power System Quality Assessment", J. Arrillaga, N.R. Watson, S .Chen
2. "Power Quality", C. Shankaran, CRC press
3. "Reactive power control in electric systems" by Timothy J. E. Miller
4. "Power Quality Enhancement Using Custom Devices" Arindam Ghosh, Gerard Ledwich

Reference Book:

1. "Power System Harmonics" Jos Arrillaga, Neville R Watson
2. "Electric Power Quality", G.T. Heydt
3. "Electric Power Systems and Quality", Roger C. Dugan, Mark F. McGranaghan, H.Wayne Beaty
4. "IEEE-519 Standard".
5. "Understanding Power Quality Problems, Voltage Sag and Interruptions" Math H.J. Bollen

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Solapur University, Solapur

B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.5. EMBEDDED SYSTEM

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hour/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand the basic functions of embedded systems.
2. To understand the applications of embedded systems and the basic structure of embedded systems.
3. To understand algorithm and logic of embedded systems.

Course Outcomes: *The students will be able;*

1. To design methodologies for embedded systems.
2. To explain the modern hardware/software tools for building prototypes of embedded systems.
3. To demonstrate practical competence in these areas.

SECTION-I

Unit 01: 8051 programming with C **(8Hrs)**

Data type & time delay, I/O programming, Logic operations, Programming Timer 0 & 1, Serial port, Interrupt programming, Accessing external data memory, programming for 8255.

Programming in C: Introduction to embedded C , Data types, memory access , Branching and looping Statements. Handling 8051 peripherals using C (S/W and H/W Programs are expected)

Unit 02: RISC processor for embedded system **(8 Hrs)**

Introduction to ARM Controller, architecture, memory organization, pipeline &cache concepts, ARM (32 bit) & THUMB (16bit) operating modes, Introduction to instruction set & assembly language programming', ARM instruction set &THUMB instruction set, switching between ARM & THUMB instructions. No assembly language programme is expected only c language.

Unit 03: LPC21xx Series (Case study LPC2148) & Programming in C (8Hrs)
Study of Architecture, memory organization and on chip resourses – I/O ports, serial port , ADC, RTC, SPI, I2C, Timers, CCP Modules. Peripheral programs using embedded C programming

SECTION II

Unit 04: Introduction to RTOS (8Hrs)
Introduction to RTOS concept, embedded software architectures: Round robin, round robin with interrupts, Function queue scheduling and real time operating system, Tasks and task states, Task scheduling, shared data and reentrancy, semaphores and shared data using semaphores, protecting shared data

Unit 05: Introduction to PLC (8 Hrs)
Basic Components and their Symbols, Fundamentals of Ladder Diagrams, Machine Control terminology, PLC configurations, System Block diagram, Physical components Vs Program components.

Unit 06: Embedded Control Applications (8Hrs)
Open-loop and Closed Loop Control Systems, Speed Control of motor, PID Controllers, Software Coding of a PID Controller, PID tuning, Fuzzy Logic Controller, Application Examples of Washing Machine, Automotive Systems and Air conditioner

Term Work:
It should consist of minimum 8 tutorials based on above syllabus.

Text Books*:*
1. 8051 microcontroller & embedded system, Pearson Publication by [1]Muhammad Ali mazidi, [2]Janice mazidi, [3]Mackinlay
2. Microcontroller (theory & application) Tata McHill by Ajay V. Deshmukh.
3. Embedded system architecture programming & design by Rajkamal, Tata McHill.

Reference Book:
1.Embedded System design : Peter Marwedel, Springer publication.
2.An Embedded Software Primer, David E. Simon Pearson Education, Asia Publication
3.ARM System developers guide designing & optimizing system software: Andrew N., Dominic Sloss, and Chris Wright.
4.Embedded System Design A Unified Hardware/ Software Introduction : Frank Vahid/ Tony Givargis ,Wiley publication
5.Embedded/ Real-Time Systems: Concepts, Design & Programming : Dr. KVKK Prasad, Dreamtech Press

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

ELECTIVE –II
4.6 MODELING OF ELECTRICAL SYSTEM

Teaching Scheme:
Lectures: 4 Hours /Week
Tutorial: 1 Hour/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks

Course Objectives:

1. To understand mathematical modeling of electrical power system.
2. To understand steady state and dynamic behavior of power system.

Course Outcomes: *The students will be able;*

1. To describe modeling of different elements of power system.
2. To explain the system planning and expansion for future demand in power system.

SECTION-I

Unit 01: Modeling of Induction Motors-I **(8 Hrs)**

Circuit model of a three phase induction motor, linear transformation, phase transformation, transformation to a reference frame, and two axis models for induction motor.

Unit 02: Modeling of Induction Motors-II **(8 Hrs)**

Voltage and current Equations in stator reference frame, equation in rotor reference frame, equations in a synchronously rotating frame, torque equation.

Unit 03: Modeling of Synchronous Machines-I **(8 Hrs)**

Basic models, electrical equations and mechanical equations, per unit system and normalization, parks transformation, flux linkages equations voltage and current equations.

SECTION-II

Unit 04: Modeling of Synchronous Machines-II (10Hrs)

Formulation of state-space equations, equivalent circuit sub transient and transient inductances and time constants, simplified model of synchronous machines, steady state equations and phasor diagram, determination of machines parameters from manufactures data.

Unit 05: Excitation system modeling (4Hrs)

Modeling of excitation system components, modeling of complete excitation system.

Unit 06: Line and load modeling (10Hrs)

Transformer model, transformer with nominal turns ratio, three winding transformers model, phase shifting transformers, load modeling, constant current model, constant impedance model, constant power model, composite load, dynamic characteristics, static load modeling for load flow studies, voltage dependence of equivalent loads, derivation for equivalent load powers.

Term Work:

It should consist of minimum 8 tutorials based on above syllabus.

Text Book:

1. P. S. Bimbhra, "Generalized theory of electrical machines", Khanna Publishers
2. Power System Dyanamics-K.R.Padiyar,B.S. Publication.
3. Power system control and Stability-Vol-I-Anderson & Foud,IEEE Press, New York.

Reference Books:

1. Power system dynamics & Control-Kundur,IEEE Press,New York
2. P. M. Anderson and A. A. Fouad, "Power System control and stability", Wiley-India Edition
3. Paul C. Krause, Oleg Wasynezuk, Scott D. Sudhoff, "Analysis of Electric Machinery", IEEE Press, 1995

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B.E. ELECTRICAL & ELECTRONICS ENGINEERING (SEM-II)

5. PROJECT

Teaching Scheme:
Practical: 8 Hours/Week

Examination Scheme:
T.W.: 100 Marks
O.E.: 100 Marks

Guidelines:

1) Project work started in Sem-I, should be continued in this semister.
2) Project hardware / software implementation & Testing work should be carried out during Sem-II
3) Project group should maintain project diary to record weekly progress of work done & to be signed by the guide.
4) Minimum 02 presentations on progress of project work should be given to guide before submission.
5) Prepare & submit project report (Part-II) which includes chapters like Introduction (to project topic), Theoretical Background, System Design (H/W & S/W design), System Implementation, Testing, Results and Conclusion.

Term work marks should be based on continuous assessment of performance based on following points:

i. Weekly meetings with guide ---------- [10M]
ii. Presentations on progress of project work (min. 02)---------- [20M]
iii. Implementation & Testing of system H/W &S/W---------- [40M]
iv. Participation in project exhibition or poster presentation or paper presentation--- [10M]
v. Report quality (neatness & contents)---------- [20M]

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