



DEE 501: Electrical and Electronics Engineering Material

Credits: 4

Semester V

Module No.	Contents	Teaching Hours
Unit – I	Conductivity of Metals: Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals	12
Unit – II	Mechanism of Conduction in semiconductor materials: Types of semiconductors, current carriers in semiconductors, Hall effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials.	12
Unit - III	Magnetic Properties of Material: Origin of permanent magnetic dipoles in matters, Classification Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism and Ferrimagnetism, magnetostriction, properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.	12

Reference Books:

Text Books : 1 A.J. Dekker, "Electrical Engineering Materials" Prentice Hall of India 2 R.K. Rajput, " Electrical Engg. Materials," Laxmi Publications. 3 C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S.Chand & Co.

References : 4 Solymar, "Electrical Properties of Materials" Oxford University Press. 5. Ian P. Hones, "Material Science for Electrical and Electronic Engineering," Oxford University Press. 8 G.P. Chhalotra & B.K. Bhat, "Electrical Engineering Materials" Khanna Publishers. 9 T. K. Basak, "Electrical Engineering Materials" New age International.



DEE 502 ELECTRICAL MACHINES - II

Credits: 4

Semester V

Module No.	Contents	Teaching Hours
Unit – I	<p>Synchronous Machines Main constructional features of commutator and brushless excitation system Generation of three phase emf Production of rotating magnetic field in a three phase winding Effect of Load on Synchronous Machines, Phasor Diagram of Synchronous Machines , Torque & Mechanical Power Developed Concept of distribution factor and coil span factor and emf equation Armature reaction on unity, lag and lead power factor Operation of single synchronous machine independently supplying a load - Voltage regulation by synch-impedance method Need and necessary conditions of parallel operation of alternators Synchronizing an alternator (Synchroscope method) with the bus bars Operation of synchronous machine as a motor –its starting methods Effect of change in excitation of a synchronous motor, V Curve, synchronous Condenser Cause of hunting and prevention Rating and cooling of synchronous machines Applications of synchronous machines (as an alternator, as a synchronous condenser)</p>	12
Unit – II	<p>Induction Motors Salient constructional features of squirrel cage and slip ring 3-phase induction motors Principle of operation, slip and its significance and connection of submersible motor (monoblock) Locking of rotor and stator fields Rotor resistance, inductance, emf and current, Rotor P.F. , Rotor frequency Relationship between copper loss and the motor slip Power flow diagram of an induction motor Factors determining the torque, Torque Equation Torque-slip curve, stable and unstable zones</p>	12

	<p>Effect of rotor resistance upon the torque slip relationship</p> <p>Double cage rotor motor and its applications</p> <p>Comparison Between Induction Motors & Synchronous Motor</p> <p>Starting of 3-phase induction motors, DOL, star-delta, auto transformer</p> <p>Causes of low power factor of induction motors</p> <p>Testing of 3-phase motor on no load rotor test and find efficiency</p> <p>Speed control of induction motor, conventional and thyristorized</p> <p>Application of Induction Motors</p> <p>Circuit Diagram</p> <p>Phasor Diagram</p>	
Unit - III	<p>Fractional Kilo Watt (FKW) Motors</p> <p>Single phase induction motors; Construction characteristics and applications, Classification</p> <p>Nature of field produced in single phase induction motor, DRFT</p> <p>Split phase induction motor</p> <p>Capacitors start and run motor</p> <p>Shaded pole motor</p> <p style="text-align: center;">Special Purpose Machines</p> <p style="text-align: center;">Construction and working principle, linear induction motor, stepper motor, Schrage motor.</p> <p style="text-align: center;">Electric Drives :</p> <p style="text-align: center;">(i) Advantages of electric drives.</p> <p style="text-align: center;">(ii) Characteristics of different mechanical loads.</p> <p style="text-align: center;">(iii) Types of motors used in electric drive.</p>	12

Reference Books:

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Engineering by JB Gupta, SK Kataria & sons, New Delhi

DEE 503: Electrical Power – I
(Generation, Transmission and Distribution of Electrical Power)

Credits: 4

Semester V

Module No.	Contents	Teaching Hours
Unit – I	<p>Electrical Design of Lines : Layout of different transmission and distribution systems, advantages of high voltage transmission, HV DC convertor transformer concept of short medium and long lines, parameters of lines, performance of short lines effects on performance of lines. Effect of provision of protection and demand side management on reduction of T & D logic.</p> <p>Constructional Features of Transmission Lines: Constructional features of transmission lines, types of supports, types of conductors, types of insulators, their properties, selection and testing, voltage distribution of string insulators Sag measurement, use of sag template Indian Electricity Rules pertaining to clearance, equalization of potential. Vibration dampers.</p> <p>Economic Principle of Transmission: Kelvin's law, limitations of Kelvin's law, Modification in Kelvin's law.</p>	12
Unit – II	<p>Mechanical design of lines : Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission line, voltage regulation concept of corona. Effects of corona and remedial measures Stringing of lines.</p> <p>Distribution System: Feeders distributors and service mains, radial and ring main distributors, A.C. distributors fed from one end and both ends. Simple problems on size of feeders and distributors.</p> <p>Construction of Distribution Lines: Lay out of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC, radial distribution system, determination of size of conductor Construction of distribution lines i.e. erection of pole, fixing of insulators on conductors, testing, operation and maintenance of lines.</p>	12
	<p>Power Factor Improvement: Effect of low power factor, causes of low power factor, necessity for improvement of power factor, methods for improving power factor. Advantages of improved power factor by installing capacitors at consumer end.</p>	

Unit - III	<p>Underground Cables: Power cable construction, comparison of over head lines and under ground cables, laying of cables, cable jointing, using of epoxy resin kits. fault location, Murray loop test, testing of cables, specifications.</p> <p>Carrier Communication: Principle of carrier communication over Power Lines, purposes, equipment, difference between radio transmission and carrier communication, block diagrams. Voltage control. Faults and Production : Causes and types of fault i.e. L-L, L-G, L-L-G. Awareness and concept of energy conservation.</p>	12
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RECOMMENDED BOOKS

1. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
2. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
3. Electrical Power –I by SK Sahdev, Unique International Publications, Jalandhar
4. Electrical Power System by VK Mehta, S Chand & CO., New Delhi
5. Electrical Power System by JB Gupta, Kataria and Sons, New Delhi
6. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
7. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi



DEE 504: POWER PLANT ENGINEERING

Credits: 4

Semester V

Module No.	Contents	Teaching Hours
Unit – I	<p>Thermal Stations: Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of make up, water, choice of pressure of steam generation and steam temperature, selection of appropriate vacuum; economizer, air pre-heater feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant heat balance and efficiency.</p> <p>Hydro-Electric Plants: Hydrology, stream flow, hydrograph, flow duration curves. Types of hydroelectric plants and their fields of use, capacity calculations for hydropower, Dams, head water control, penstocks, water turbines, specific speeds. turbine governors. Hydro plant auxiliaries, plant layout, automatic and remote control of hydro plants, pumped storage projects, cost of hydro-electric project. Cooling of alternators.</p>	16
Unit – II	<p>Nuclear Power Plants: Elements of nuclear power plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.</p> <p>Diesel Power Plants: Diesel engine performance and operation. Plant layout. Log sheets, applications selections of engine size.</p> <p>Gas Turbine Plants: Plant layout, methods of improving output and performance. Fuels and fuel systems. Methods of testing. Open and closed cycle plants. Operating characteristics. Applications. Free piston engine plants, limitation and applications. Non conventional energy sources.</p>	16
Unit - III	<p>Combined Working of Power Plants: Advantages of combined working of different types of power plants. Need for co-ordination of various types of power plants in power systems, base load stations and peak load stations.</p> <p>Non Conventional Source of Energy: Introduction, Concept of Solar Energy, Bio Mass Energy, Wind Energy, Tidal Energy, Geothermal Energy, Microhydel Energy, Biodiesel</p>	16

Energy.

Recent Development :

Interconnection of P.S. - Meaning of Interconnection, combined operation of hydro power station with inter connected base load and peak load, parallel operation of inter connectors.

RECOMMENDED BOOKS

1. A Course in Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai and Co. Pvt. Ltd., New Delhi.
2. Power Plant Engineering by P.K. Nag, Tata McGraw Hill, Second Edition, Fourth reprint 2003.
3. Power station Engineering and Economy by Bernhardt G.A. Skrotzki and William A. Vopat Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
4. An introduction to power plant technology by G.D. Rai Khanna Publishers, Delhi - 110 005.
5. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.



DEE 505:SWITCH GEAR &PROTECTION

Credits: 4

Semester V

Module No.	Contents	Teaching Hours
Unit – I	<p>Faults: Types of faults, three phase symmetrical faults, effects of faults on system reliability and stability abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams.</p> <p>Switch Gear: Purpose of protective gear, characteristics of a protection system. Classification of fuses H.V. Fuses, application and working, grading and co-ordination L.V. fuses, selection of fuses, characteristics. Isolators and switches, out door isolators, functions, air break switches braking capacity of switches. Circuit breakers :- requirements of circuit breakers definition of terms associated with circuit-breakers, reasons for arc formation, principles of arc extinction, types of circuit-breakers, comparison with oil circuit breaker classification, rating of circuit breakers, working of different types of air and oil circuit breaker, specification of circuit breakers, maintenance schedule. SF 6 and Vacuum circuit breakers. Relays : Requirement of relays, operation principles induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction of distance relay.</p>	16
Unit – II	<p>Protective Schemes: Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults their reasons, effect and protections used. Protection of power transformer : types of faults, its effects, types of protective schemes over current earth fault, differential protection, Buchholtz devices, winding temp. protection. Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection. Protection of feeders : radial, parallel and ring feeders protection, directional time and current graded schemes differential protection.</p> <p>Protection Against Over Voltages: Causes of over voltages, travelling waves earth wire, protective zone, lightning arrestors, space-gap and electrolytic arrestors, surge absorber, location and rating of lightning arrestors. Thyrite lightning arrestor.</p>	16

Unit - III	<p>Different Type of Sub-Stations:- Layout, single line diagram bus bar arrangement, equipments their functions, accessories, study of protective schemes, etc. batteries and their maintenance, operation of small sub-station. Reactors: types of reactors, bus bar reactor, tuning reactor, arc-suppression reactor, connection of reactors in power stations. uses of reactors. Neutral grounding :- types of grounding solid grounding, reactance grounding, arc suppression coil grounding, choice of method of neutral earthing. grounding of sub-station, grounding of line structure and sub station equipment. Concept of G.I.S. (Gas Insulated Substation).</p>	16
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Text Books:

1. Rao S. S. "Switchgear and Protection", Khanna Publishers.
2. Ravindranath B. and M. Chander "Power system Protection and Switchgear", Wiley Eastern Ltd.

Reference Books:

1. Ram B. and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill
2. Paithankar Y. G. and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
3. Rao T. S. M, "Power System Protection: Static Relays with Microprocessor",



DEE 551: ELECTRICAL MACHINES – II Lab

Credits: 2

Semester V

LIST OF PRACTICALS

Module No.	Contents
1	Synchronous Machines: Demonstration of revolving field set up by a 3-phase wound stator
2	Determination of excitation
3	Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant
4	Determination of the regulation and efficiency of alternator from the open circuit and short circuit test
5	Parallel operation of polyphase alternators and load sharing
6	Determination of the effect of variation of excitation on performance of a synchronous motor
1	Induction Machines: Determination of efficiency by (a) no load test and blocked rotor test on an induction motor (b) direct loading of an induction motor (refer ISI Code/BIS code)
2	Determination of effect of rotor resistance on torque speed curve of an induction motor
1	FKW Motors: To tell the effect of a capacitor on the starting and running of a single-phase induction motor.
2	Reversing the direction of rotation of ceiling fan

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Engineering by JB Gupta, SK Kataria & sons, New Delhi