Integral University, Lucknow
University Polytechnic
Study and Evaluation Scheme
Program: Diploma in Electrical Engineering

Semester V

S. No.	Course Code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits	Attributes						
				L	T	P	CT	TA	Total	ESE				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics
THEORIES																				
1	DEE-501	Switch Gear and Protection	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y		Y				
2	DEE-504	Electrical Machines-II	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y				
3	DEE-505	Installation Maintenance and Repair of Electrical Machines	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y				
4	DEE-506	Utilization of Electrical Energy	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y				
5	DEE-507	Power Electronics-I	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y		Y				
6	DEV-501	Environmental Education and Disaster Management	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y		Y		
PRACTICAL																				
7	DEE-553	Power Electronics-I Lab	Core	00	00	03	40	20	60	40	100	0:0:1.5	1.5	Y		Y				
8	DEE-554	Electrical Machines-II Lab	Core	00	00	03	40	20	60	40	100	0:0:1.5	1.5	Y	Y	Y				
9	DEE-555	Installation Maintenance Lab	Core	00	00	03	40	20	60	40	100	0:0:1.5	1.5	Y	Y	Y				
10	DEE-557	Field Exposure	Core	-	-	-	-	-	-	40	40			Y		Y		Y		Y
11	GP-551	General Proficiency		-	-	-	-	-	60	-	60								Y	Y
Total				**18**	**06**	**09**	**360**	**180**	**600**	**400**	**1000**		**28.5**							

SWITCH GEAR AND PROTECTION
(DEE-501)

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Unit 1 **8**

FAULTS
Types of faults, symmetrical and asymmetrical fault representation, effect of short circuit fault on power system, representation of fault condition through single line diagram, per unit system, simple numerical problems on per unit systems

Unit 2 **8**

CIRCUIT INTERRUPTION DEVICES
Fuse isolator and circuit breaker, arc extinction principle, circuit breaker classification, constructional features and operating principle of modern circuit breakers (Air,oil,SF6,Vaccum)

Unit 3 **8**

RELAY RELAYING CIRCUITRY
Faults: types and nature. Causes and consequences: requisite of protective scheme, relay and their classification. Induction type overcurrent and reverse power relay. Over current. Ground fault. Directional and directional over current relaying circuitry. Different types of static relay and relaying circuitry for over current and ground fault protection

Unit 4 **8**

SYSTEM PROTECTION
Principle of distance protection. Impedance relaying scheme for protection of feeder. Principle of differential protection. Merz price system for protection of electrical machines. General schemes for power protection system components.

Unit 5 **8**

SURGE PROTECTION AND SYSTEM GROUNDING
Production and consequences of surge. Modern surge diverters. Protection against surges. Grounding and its methods. Grounding of dead metallic parts and neutral.

Reference Books:
1. Power system protection and switch gear: Badri Ram
2. Switch gear protection: S.S Rao
3. Switch gear protection: M.V. Desh Pandey
4. Power system protection and switch gear: Ravindranath

UTILIZATION OF ELECTRICAL ENERGY
(DEE-506)

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UNIT 1 **7**

ILLUMINATION

Definition (illumination, luminous intensity, illumines efficiency, law of illumination, flux, solid angle), Problems on illumines for calculation of number of light points and illumination at different points, Sodium lamp and Discharge lamp, Difference between Incandescent and Discharge lamp

UNIT 2 **9**

ELECTRIC HEATING

Advantage of electric heating, Resistance heating (direct resistance and indirect resistance heating), Electric arc heating, Induction heating and Dielectric heating, Electric ovens

ELECTRIC WELDING

Classification of welding methods, Resistance welding (butt, spot, projection, seam and percussion welding), Electric arc welding, Under water welding, Welding equipment

UNIT 3 **7**

ELECTRIC COOLING

Concept of refrigeration and air conditioning, define ton, refrigerant and their examples
Vapor compression refrigeration cycle
Electric circuit used in refrigerator, air condition, water cooler

UNIT 4 **9**

ECONOMIC CONSIDERATION

Load factor, demand factor, load curve, load estimation, diversity factor, plant capacity factor and utilization factor (simple problem on above factors)
Tariff and type of tariff (flat rate, block rate, maximum demand and two parts tariffs), fixed cost and running cost, economic load division between power stations.

ENERGY CONSERVATION

Need of energy conservation, energy management, basic idea of energy audit

UNIT 5 **8**

ELECTRIC TRACTION

Advantage of electric traction, AC and DC electric traction system, accessories for track electrification, block diagram of locomotive, electric braking (plugging, rheostat and regenerative braking) types of pantograph, suburban and rural electrification, typical speed time curve and simplified speed time curve

Reference Books:

1. Utilization of electrical energy: Sharma K Nath
2. Transmission Distribution and Utilization of Electrical Energy: C.L. Wadhwa
3. Utilization of Electrical Energy: J.B.Gupta

POWER ELECTRONICS-I
(DEE-507)

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UNIT 1 **8**

INTRODUCTION
Concept of power electronics, application of power electronics, advantages and disadvantages of power electronics converters, types of power electronics converters
Thyristor family: PUT, SUS, SAS, light activated thyristor, DIAC, TRIAC, GTO (symbols and characteristics)

UNIT 2 **8**
HIGH POWER SWITCHING DEVICES
Power semiconductor diode: V-I characteristic, reverse recovery characteristics
Types of power diodes: general purpose diode, fast recovery diode, schottky diode
Power transistors: BJT, MOSFET, IGBT

UNIT 3 **8**
DIODE CIRCUIT AND RECTIFIER
Introduction. **Single phase half wave rectifier:** R load, L load, RLE Load, RL load. **Single phase full wave rectifier:** mid point rectifier, Bridge rectifier(R load, RL load) Concept of free-wheeling diodes. Three phase converter system using diodes

UNIT 4 **8**
THYRISTORS
Constructional details of thyristor
Characteristic of thyristor: Reverse blocking mode, forward blocking mode, forward conduction mode Thyristor turn on methods: forward voltage triggering, gate triggering, dv/dt triggering, temperature triggering, light triggering Switching characteristic of thyristor during turn on and turn off. UJT(symbol, characteristic and application) **Thyristor protection:** di/dt protection, dv/dt protection , snubber circuit

UNIT 5 **8**
CONTROLLED RECTIFIER
Single phase half wave converter with R load, RL load and free wheeling diode' with RLE load(working and waveform) single phase full wave convertor: mid point converter , bridge converter. Single phase semi converter. Three phase full converter system using thyristor only for R circuit

Reference books:
1 Industrial Electronics: D.C. Gupta
2 Indutrial Electronics and Control: Bhattacharya
3 Power Electronics: P.S.Bhimbra

ELECTRICAL MACHINES II

(DEE-504)

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Unit 1

Induction Motor:
Construction and working of 3 ph. Induction motor and its types. Double cage induction motor, rotor frequency, rotor emf, rotor current, rotor power factor, torque equation, torque slip characteristic, principle and methods of speed control. Methods of starting, losses and efficiency(simple problems), Testing of motors as per I.S.

Unit 2

Synchronous motor:
Construction , working principle, effect of load on synchronous motor, its vector diagram, effects of change in excitation on performance of synchronous motor, V curve, torque an mechanical power developed, condition for max. Mechanical power, synchronous condenser, hunting and its elimination, starting methods and its uses

Unit 3

A.C. Generators:

Working principle , construction , full pitch and short pitch winding, pitch factor and winding factor, E.M.F. equation, rating of alternator, armatue reaction, voltage drop in alternator, vector diagram of loaded alternator, voltage regulation and its determination, efficiency of alternator, condition for parellel operation, voltage regulation, operation of alternator when connected to infinite bus bar

Unit 4

F.H.P. Motors:
Classification of F.H.P. motors, Double field revolving theory, construction , working and application of capacitor motor(all types), shaded pole motor, 1 ph. Synchronus motor, 1 ph. Series and universal motor

Unit 5

Electrical Drives:
Advantages of Electrical Drives . characteristic of different mechanical loads. Types of motor used in electrical drives. Specification of commonly used motors, selection of motors for particular loads.

Ref Books:

1. Electrical Technology Vol –II : B.L.Theraja.
2. Electrical Machine: Ashfaque Hussain.

Installation Maintenance and Repair of Electrical Machines

(DEE-505)

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Unit 1

Installation and maintenances:
Guidelines for loading and unloading of electrical machines, Accessories used in loading and unloading, precaution taken during loading and unloading. Installation of electrical equipments, their testing and commissioning, precaution taken while installation. 8

Unit 2

Preventive maintenance of Electrical equipment and other installations:

Meaning of preventive maintenance, its advantage, preparation of preventive maintenance schedule for transformers , transmission lines, induction motors , circuit breakers, underground cables and storage batteries 8

Unit 3

Trouble Shooting:
Causes for failure of electrical equipments. Classification of faults under (1) electrical (2) magnetic (3) mechanical . Tools and instruments used for trouble shooting and repair. Diagnosis of faults in (1)d.c. machines (2) synchronus machines (3) transformers (4) induction motors (5) circuit breakers (6) overhead and underground distribution lines . 8

Unit 4

Earthing arrangement:

Reason for earthing of electrical equipments , earthing systems permissible earth resistance for different types of installation , methods of improving the earth resistance, measurment of earth resistance . system earthing and equipment earthing. 8

Unit 5

Insulation testing:
Classification of insulation as per ISS 1271/1958. Insulation resistance measurment , methods of improving insulation resistance , vaccum impregnation , transformer oil testing and interpretation
Electrical accidents and safety:
Classification of electrical accidents, treatment for electric shock, artificial respiration . general ideas about protection against lightning . Indian electricity rules . 8

Ref Books:

1. Installation, Maintenance of Electrical Engg. Equipment: Basant Kumar.
2. Testing, Commissioning, Operation and Maintenance of Electrical Equipment: S. S. Rao

ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

(DEV-501)

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UNIT-I
INTRODUCTION;
Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigation, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.
- Lowering of water level , Urbanization.
- Biodegradation and Biodegradibility, composting, bio remediation, Microbes .Use of biopesticidies and biofungicides.
- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc Sources of pollution, natural and man made, their effects on living environments and related legislation.

UNIT-II
WATER POLLUTION & NOISE POLLUTION
Factors contributing water pollution and their effect.
- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.
- Physical, Chemical and Biological Characteristics of waste water.
- Indian Standards for quality of drinking water.
- Indian Standards for quality of treated waste water.
- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal Sources of noise pollution, its effect and control.

UNIT-III
AIR POLLUTION AND RADIOACTIVE POLLUTION
Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, GO, CO2, NH3, F, CL, causes and its effects on the environment.
- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.
A. Settling chambers
B. Cyclones
C. Scrubbers (Dry and Wet)
D. Multi Clones
E. Electro Static Precipitations
F. Bog Fillers.
- Ambient air quality measurement and their standards.
- Process and domestic emission control
- Vehicular Pollution and Its control with special emphasis of
Euro-I, Euro-II, Euro-III and Euro IV. Sources and its effect on human, animal, plant and material, means to control and preventive measures.

UNIT-IV
SOLID WASTE MANAGEMENT AND LEGISLATIONS
Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.
Preliminary knowledge of the following Acts and rules madethere under-
- The Water (Prevention and Control of Pollution) Act - 1974.
- The Air (Prevention and Control of Pollution) Act - 1981.
- The Environmental Protection (Prevention and Control of
Pollution) Act -1986. Rules notified under EP Act - 1986
Viz.
The Manufacture, Storage and Import of Hazardous
Chemical (Amendment) Rules, 2000
The Hazardous Wastes (Management and Handling)
Amendment Rules, 2003.
Bio-Medical Waste (Management and Handling) (Amendment)
Rules, 2003.

The Noise Pollution (Regulation and Control)
(Amendment) Rules, 2002.
Municipal Solid Wastes (Management and Handling) Rules,
2000.
The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

UNIT-V

ENVIRONMENTAL IMPACT ASSESSMENT(EIA) AND DISASTER MANAGEMENT

Basic concepts, objective and methodology of EIA. Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benifit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human

Resource Development and Function, Information dissemination and communication.

INSTALLATION MAINTENANCE LAB

(DEE-555)

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List of experiments

1. Setting handling of tools and accessories for installation of heavy equipment.
2. Commissioning of electrical equipments
3. Measurement of earth resistance
4. Testing of transformer oil
5. Fault finding and repairing of different types of electrical wiring
6. Disassembling and assembling of electrical machines e.g electric iron , washing machine ,geyser,submersible pumps, coolers etc.
7. Trouble shooting and repairing of different types of domestic and industrial electrical equipment.
8. Wiring of small ac motor/transformer/chokes.
9. Cable jointing using epoxy resin kits.
10. Repair and maintenance of circuit breakers upto 11 Kv
11. Trouble shooting and repair of direct on line and star delta starter

POWER ELECTRONICS-I LAB
(DEE-553)

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Perform any ten experiments of the following

1. To study and plot V-I characteristics of SCR
2. To study the characteristics of UJT
3. To study the characteristics of MOSFET
4. To study the characteristics of IGBT
5. To study the characteristics of Diac
6. To study the characteristics of Triac
7. To study the characteristics of PUT
8. Study the resistor capacitor (R-C) triggering
9. To study the phenomena of holding current and latching current in SCR
10. Study of three phase half wave rectifier (common cathode configuration) with R load
11. Study of three phase diode bridge rectifier with R load
12. Study the triggering of SCR using UJT
13. Study of full wave controlled mid-point rectifier with R load

ELECTRICAL MACHINE II LAB

(DEE-554)

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1. To determine performance characteristics of a poly phase induction motor (load Vs efficiency , load Vs power factor, load Vs slip)

2. To start a three phase induction motor and to determine its slip at various load

3. To determine V curve of a synchronous motor.

4. To connect and start an induction motor by using star delta starter, auto transformer starter, rotor starter and to change its direction of rotor.

5. To perform open circuit and block rotor test on a three phase induction motor and to determine its efficiency

6. Determination of performance curve and hence the coreloss of single phase series motor.

7. To perform open circuit and short circuit test on a 3 phase synchronous machines and to determine synchronous impedance and regulation at leading/lagging power factor .

8. Sequential operation of motors using timers.

9. Achieving high starting torque in case of 3 phase slip ring motor by increasing external resistance in rotor circuit and determine speed regulation at different loads