PEOPLE'S UNIVERSITY, BHOPAL

(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: **Diploma in Electrical Engineering** **Semester –V**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
DEE1502	Electrical Power Generation	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks:- Nil	Assignment / Quiz/Attendance-- Max. Marks:- Nil

Pre-Requisite	Knowledge of generating power plant.
Course Outcome	1. To understand the development of electrical energy needs of various consumer areas.
	2. Introduction to thermal power generation and their drawbacks and impact on the environment.
	3. Introduction to renewable energy resources and their advantages over conventional sources.

Unit	Contents (Theory)	Marks weightage
I	**Choice of power station and unit:** Introduction to various equipments and machinery used in power station like generator, transformer (current transformer, potential transformer), circuit breakers, relays, capacitor banks, boiler etc. Power Station auxiliaries, Cooling system of alternators.	**14**
II	**Nuclear Power Station:** Principles of Nuclear reaction, Layout of Nuclear Power Station, Types of power reactors, Main parts and Control reactors, Nuclear waste disposal, Radioactivity and Hazards.	**14**
III	**Hydroelectric Power Station:** Stream flow, Hydrographs, Flow duration curve, Arrangement and location of hydroelectric stations, Principle of working, Power station control, Pump and Storage system.	**14**
IV	**Thermal Power Station:** Basic introduction of Thermal power Station, working of thermal power station, main parts of thermal power plant, main flow circuit of thermal power station, power station auxilies.	**14**
V	**Introduction of non-conventional energy sources:** Solar Energy, Wind electricity, Energy from Biomass gasifies and Biogas reactors, Tidal energy, geothermal energy.	**14**

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Text Book/References Books/ Websites

1. G. R. Nagpal, Power Plant Engineering, Khanna Publisher
2. M.V. Deshpandey, Modern Design of Power Station.
3. K. K.Ramaligaum Power Plant Engineering,SciTech

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External (35)	Internal (15)	Total (50)
DEE1503	Electric Drives - I	3	1	1	External (70)	Internal (30)	Min: 40 (D Grade)	Min: 14 (D Grade)	Min: Nil	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks:- 10	Assignment / Quiz/Attendance-- Max. Marks:- 05

Pre-Requisite	Knowledge of Power Electronics.
Course Outcome	1. Introduction to Electrical drives and their applications in the Industry.
	2. Review of conventional methods & convertor control methods used in speed control of DC motor.
	3. Various power recovery schemes in drives to improve the efficiency of the drives in industry.

Unit	Contents (Theory)	Marks weightage
I	Introduction- Basic Concepts of Electric Drives, Merits and demerits of electric drives, factors governing selection of Electrical Drives, classification of Electrical Drives, starting and running characteristics of various motors, etc.	**14**
II	Block Diagram representation of Electrical Drives, Elements of drive systems, Requirement of electric drives, Fundamental torque equation, load equalization, use of fly wheel etc.	**14**
III	Motor Mechanism dynamics: Review of Characteristics of AC & DC motors, load characteristic, component of load torque, nature and classification of load torque, quadrant speed torque characteristics, four quadrant operation of full convertor and semi convertor, four quadrant convertor, non circulating current type and circulating current type, difference between AC drives and DC drives etc.	**14**
IV	DC Drives: Introduction to DC Drives and speed controlling, Armature voltage control, Flux control, Introduction to Electrical Braking, Types of Electrical Braking Phase controlled and chopper controlled drives, Transient & Steady state analysis, Energy recovery systems.	**14**
V	Introduction to starters, Types of starters, Manual starters, Magnetic motor starters, liquid resistor type starter, motor starter features, .Motor enclosures, selection of motors for particular service etc.	**14**

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Text Book/References Books/ Websites

1. Pillai S. K. ; "A first course on Electrical Drives"; Second edition, Wiley Eastern.
2. Dubey G. K. ; "Fundamentals of Electrical Drives"; Narosa Publishing House.
3. Murphy M. D. and Tumbuli F.; "Power Electronic Control of AC Motors"; Pergamon Press, Oxford University Press.
4. P.V. Rao; "Power semiconductor Drives"; BS Publications
5. Dubey G. K.; "Power Semiconductor Controlled Drives"; Prentice-Hall, Englewood Cliffs!
6. Bose B. K.; "Power Electronics and AC Drives"; Prentice-Hall.

Suggested List of Laboratory Experiments :- (Expandable):-

1. To study the electrical braking of a DC drive.
2. To control the speed of DC shunt motor using armature voltage control.
3. To control the speed of DC shunt motor using armature flux control.
4. To study the performance of a permanent magnet brushless dc motor drive.
5. To study the starting and running characteristics of converter fed DC traction motor.

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External (35)	Internal (15)	Total (50)
DEE1504	Switchgear & Protection	3	1	1	External (70)	Internal (30)	Min: 40 (D Grade)	Min: 14 (D Grade)	Min: Nil	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks:- 10	Assignment / Quiz- Max. Marks:- 05

Pre-Requisite	Knowledge of protective device and power system.
Course Outcome	1. Ability to maintain different types of protective relays in power system for primary and backup protection.
	2. Maintain different types of circuit breakers in power system also Knowledge of the fundamental components and arc.
	3. Student will be able to protect transformer, alternator, motor and bus bar.

Unit	Contents (Theory)	Marks weightage
I	**Introduction to Protection System**: Functions of protective relaying, protective zones primary and backup protection, desirable qualities of protective relaying, basic terminology. Relays: Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay.	**14**
II	**Relay Application and Characteristics:** Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay. **Static Relays:** Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.	**14**
III	**Protection of Transmission Line:** Over current protection, distance protection, pilot wire protection carrier current protection, protection of bus, auto reclosing,	**14**
IV	**Circuit Breaking**: Properties of arc, arc extinction theories, restriking voltage transient, current chopping resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings. Testing of Circuit Breaker: Classification, testing station and equipments, testing procedure, direct and indirect testing.	**14**
V	**Apparatus Protection**: Protection of transformer, Buccholz relay, generator and motor. Circuit Breaker: Operating modes selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast SF6, Vacuum and DC circuit breakers.	**14**

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Text Book/References Books/ Websites

1. Rao S. S. "Switchgear and Protection",Khanna Publishers.
2. Ravindranath B. and M. Chander "Power system Protection and Switchgear", iley Eastern Ltd.
3. Ram B. and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill
4. Paithankar Y. G. and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
5. Rao T. S. M, "Power System Protection: Static Relays with Microprocessor",

Suggested List of Laboratory Experiments :- (Expandable):

1. To study different switchgear equipments used in electrical power system.
2. To identify the components of different types of circuit breakers with their specification.
3. To study various types of over current relays and to plot the performance characteristics of an over current relay.
4. To understand the protection schemes of alternator and to sketch labeled schematic diagram of various types of protection of alternation.
5. To understand the protection scheme of transformer through a visit to local high voltage substation and to sketch labeled schematic diagram of various types of protection of transformer.
6. To understand various types of neutral earthling and specifications of earthling at different substation different location and new trends in earthling.

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External (35)	Internal (15)	Total (50)
DEE1505	Power Electronics	3	1	2	External (70)	Internal (30)	Min: 40 (D Grade)	Min: 14 (D Grade)	Min: Nil	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks:- 10	Assignment / Quiz/Attendance - Max. Marks: -05

Pre-Requisite	Knowledge of different power electronics device.
Course Outcome	1. Introduction of power electronic device and brief description of SCR.
	2. Principle of operation of GTO,MOSFET, IGBT.
	3. Detail description of inverter and their utilization.

Unit	Contents (Theory)	Marks weightage
I	Advantages and application of power electronic devices characteristics, Symbol & application of power diodes, power transistors, Principle of operation of SCR, brief idea of construction of SCR, Static characteristics of SCR, Method for turning on of SCR, Turnoff methods.	**14**
II	Principle of operation of GTO, Principle of operation of MOSFET, Principle of operation of IGBT. And characteristics of GTO, MOSFET, IGBT	**14**
III	Series and parallel inverter, Voltage source & current source inverter, Single phase and three phase bridge inverter, Self cumulated inverters.	**14**
IV	Voltage control of single phase and three phase bridge inverter, Harmonics & their reduction techniques.	**14**
V	Operation and analysis of single phase (Half wave & Full Wave) and multiphase (Three Phase) controlled rectifier circuit.	**14**

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Text Book/References Books/ Websites

1. M Ramsmoorthy, An Introduction to transistor and their application, Affiliated East-West Press.
2. P.C. Sen, Power Electonics, TMH.
3 Chakravarti A., Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.,
4 Dr. P.S. Bhimbhra, Power Electonics, Khanna Pub.
5 Vedam Subramanyam, Power Electronics New Age International Revised II ed. 2006.

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Suggested List of Laboratory Experiments :- (Expandable):

1. To Study & plot the V-I characteristics of the SCR.
2. To draw V-I characteristics of IGBT.
3. Study of SCR commutation circuits and check the performance of one commutation circuit.
4. Thyristorised speed control of a D.C. Motor.
5. Speed Control of induction motor using Thyristor.
6. To Study V-I charecteristics of full wave rectifier with R load.

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External (35)	Internal (15)	Total (50)
DEE1506	Minor Project	-	-	1	External (Nil)	Internal (Nil)	Nil	Min: 14 (D Grade)	Min: Nil	Min: 20 (D Grade)

Duration of Theory (Externals): - Nil

Theory Internal- Max Marks: -Nil	Best of Two Mid Semester Test – Max Marks: -Nil	Assignment/Quiz/Attendance Max. Marks: -Nil
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks: 10	Assignment / Quiz/ Attendance Max. Marks: 05

Pre-Requisite	Student should have basic knowledge of engineering principles.
Course Outcome	The student will be able to-An ability to utilize technical resources.
	1. Identify, analyze & define the problem.
	2. Generate alternative solutions to the problem identified.
	3. Compare & select feasible solutions from alternatives generated.
	4. Compare machines/devices/apparatus for performance practices.
	5. Work effectively in a team.

Unit	Contents (Theory)	Marks Weightage
I	The student should prepare a working system or some design or understanding of a complex system (on minor level) that he/she has selected for his/her minor project work using system analysis tools and submit the same in the form of a write-up i.e. detail project report. The student should maintain proper documentation of different stages of project such as concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan wherever applicable. Each student is required to prepare a project report based on the above points and present the same at the final examination with a demonstration of their project.	**50**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External (70)	Internal (30)	Total (100)
DEE1507	Industrial Training-II	-	-	2	External (Nil	Internal (Nil)	Nil	Min: 28 (D Grade)	Nil	Min: 40 (D Grade)

Duration of Theory (Externals): - Nil

Theory Internal- Max Marks: -Nil	Best of Two Mid Semester Test – Max Marks: -Nil	Assignment/Quiz/Attendance Max. Marks: -Nil
Practical Internal Max Marks: 30	Lab work & Sessional – Max Marks: 25	Assignment / Quiz/ Attendance Max. Marks: 05

Pre-Requisite	Basic principles and theory knowledge of concern discipline of engineering.
Course Outcome	1. To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, seminars on technical topics and group discussion. Correlate theoretical knowledge with practical engineering work. 2. Ability to learn under actual working environment.

Unit	Contents (Theory)	Marks Weightage
I	As a part of the Diploma in Engineering curriculum, DEE1507, Industrial Training II is a Practical course, which the students should undergo in reputed Private / Public Sector / Government organization / companies as industrial training of minimum two weeks to be undergone by the student in the semester break after IV semester theory examinations. **Training period**: Minimum of two weeks or 15 (Fifteen) Days. **Companies / Areas covered**: Any field related to concern branch / discipline of Diploma in Engineering. **Grading**: As per Scheme. **Note:** Presentation will take place the following week after you complete your training in IV semester. The presentation is evaluated by your class in charge. Report must be submitted during power point presentation. A Viva voce comprising comprehensive questions based on your training undergone. **Etiquette:** Dress properly, Behave well, Portray good image as a university student, Be punctual, Observe work ethics, Concern for safety, Be professional.	**100**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
DEE15011	Electrical Power Transmission & Distribution	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: -Nil	Assignment / Quiz- Max. Marks: -Nil

Pre-Requisite	Knowledge of Transmission & distribution parameters of Electrical Power
Course Outcome	1. Ability to understand and analyze power system operation, stability, control and protection
	2. To understand the operation of the distribution schemes
	3. To develop expressions for the computation of transmission line parameters

Unit	Contents (Theory)	Marks weightage
I	**STRUCTURE OF POWER SYSTEM -** Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors, distributed and concentrated loads, interconnection, EHVAC and HVDC transmission, Introduction to FACTS.	**14**
II	**TRANSMISSION LINE PARAMETERS -** Parameters of single and three phase transmission lines with single and double circuits – Resistance, inductance and capacitance of solid, stranded and bundled conductors skin and proximity effects, interference with neighboring communication circuits, conductor types and electrical parameters of EHV lines, corona discharges.	**14**
III	**MODELLING AND PERFORMANCE OF TRANSMISSION LINES -** Classification of lines – short line, medium line and long line ,equivalent circuits, Phasor diagram, attenuation constant, phase constant, surge impedance, transmission efficiency and voltage regulation, real and reactive power flow in lines, Ferranti effect.	**14**
IV	**INSULATORS AND CABLES –** Insulators, Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators. Underground cables – Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables.	**14**
V	**MECHANICAL DESIGN OF LINES AND GROUNDING -** Mechanical design of transmission line – sag and tension calculations for different weather conditions, Tower spotting, Types of towers, Substation Layout (AIS, GIS), Methods of grounding.	**14**

Text Book/References Books/ Websites

1. Rattan SS; Theory of Machines; TMH
2. Ambekar AG; Mechanism and Machine Theory; PHI.

Suggested List of Laboratory Experiments :- (Expandable):Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External (35)	Internal (15)	Total (50)
DEE15012	Electrical Design Drawing & Estimation	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: -Nil	Assignment / Quiz- Max. Marks: -Nil

Pre-Requisite	Knowledge of basic electrical equipment
Course Outcome	1. Estimating and costing market survey ,calculation of material and labour cost, idea of tender
	2. Earthing of electrical installation, pipe earthling and plate earthling and determine earth wire size
	3. Estimation of power wiring, determine size of cable ,main switch and starter of power circuit

Unit	Contents (Theory)	Marks weightage
I	**Principles of Estimating and Costing:** Purpose of estimating and costing, essentials of estimating and costing-market survey, price list and net prices, preparation of list of materials, calculation of material and labour cost, contingencies, overhead charges, profit and total cost, quotations-comparative statement and orders, idea about tender forms.	**14**
II	**Earthing:**-Need for earthing of electrical installations, advantages and disadvantages, effect of improper earthing, I.S. specifications regarding earthing of electrical installations, points to be earthed as per I.E. rules. Methods of earthing-plate and pipe earthing. Determination of size of earth wires and earth plates for different capacities of electrical installations, specification of earthing materials and their cost, Earthing of power plant and grid substation.	**14**
III	**Estimation of Power Wiring:-** I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductor's distribution board, main switches and starters for power circuits. Cost of equipments and accessories and schedule of materials. Estimation and cost of material and work for small workshops.& lecture hall.	**14**
IV	**Estimation of Overhead and Underground Distribution Lines:-** Main components of overhead lines-line supports, cross-arm, clamps, conductors and stay sets, lightening arrestors, danger plates, ant climbing devices, bird guards, jumpers etc., concreting of poles, earthing of transmission line, formation of lines, specification of materials for O.H. lines, I.S. specification and I.E. rules. Cost of material and work for overhead and underground lines upto 11 KV only.	**14**
V	**Estimation of Small Sub-Station:-**Main equipments and auxiliaries installed on the substation. Estimation of materials required for a small distribution substation (indoor and outdoor type-platform and pole mounted). Costing of material and work of above substations.	**14**

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Text Book/References Books/ Websites

1. K Bhattacharya, "Electrical Engineering Drawing & Design Estimating". Wiley Eastern Ltd. New Delhi.
2. Surjeet Singh, "Electrical Eesign & Drawing" S.K.Kataria & Sons New Delhi.

Suggested List of Laboratory Experiments :- (Expandable):Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
DEE15013	Electrical Traction	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: -Nil	Assignment / Quiz/Attendance - Max. Marks: - Nil

Pre-Requisite	Knowledge of machine.
Course Outcome	1. Differentiate services of traction system based on speed time curve.
	2. Control different types of traction motors.
	3. Use various traction system auxiliaries.

Unit	Contents (Theory)	Marks weightage
I	**Introduction :**-General features of electrical traction, Mechanics of train movement, Nature of traction load, Speed-time curves, Calculations of traction drive rating and energy consumption, Train resistance, Methods of speed control and braking of motors for traction load, Electric drive systems for electric traction.	**14**
II	**Traction Systems and Latest Trends:-** types of traction systems and their significance. Steam, diesel, diesel-electric, Battery and electric traction systems State the desirable features of traction motors. Compare different traction motors. Explain different types of electric braking system	**14**
III	**Fundamental of Electric Drives:** Basic concepts, Characteristics and operating modes of drive motors, Starting, braking and speed control of motors, Selection of motors and rating.	**14**
IV	**Traction Motors:-** working of various A.C. motors as traction motors. Compare different traction motors. Features of traction motors, Working of D.C. series motor as traction motor	**14**
V	**Traction Systems and Latest Trends:-** Detail the latest trends in traction. General arrangement of different types of Electric traction systems and their significance	**14**

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Text Book/References Books/ Websites

1. Rattan SS; Theory of Machines; TMH
2. Ambekar AG; Mechanism and Machine Theory; PHI.

Suggested List of Laboratory Experiments :- (Expandable):Nil