

SCHOOL OF DIPLOMA STUDIES	PROGRAM: DIPLOMA – ELECTRICAL ENGINEERING
ACADEMIC YEAR - 2018-19	SEMESTER – V BATCH YEAR: 2016-19
DEFINITION OF ONE CREDIT: 1. Lecture(L): 1 hour / week / semester, 2. Practical(P): 2 hour / week / semester 3. Tutorial(T): 2 hour / week / semester	

Course Code	Course Name	Teaching Hours			Credits	Audit course	CIE	PSEE
		Theory	Tutorial	Practical				
DEE519	INSTALLATION & MAINTENANCE OF ELECTRICAL EQUIPMENTS	3	0	2	4	N	Y	Y
DEE520	ELECTRICAL SWITCHGEAR & PROTECTION	3	0	2	4	N	Y	Y
DEE521	ELECTRICAL POWER SYSTEM-2	3	0	2	4	N	Y	Y
DEE516	ELECTRICAL WIRING, ESTIMATING, COSTING & CONTRACTING	3	2	2	5	N	Y	Y
DEE523	MINI PROJECT	0	0	2	1	N	Y	Y
	ELECTIVE: II	3	0	2	4	N	Y	Y
DEE517	ELECTRICAL TRACTION AND CONTROL							
DEE522	GREEN ENERGY TECHNOLOGIES							
DEC413	INDUSTRIAL ELECTRONICS							
	Total	15	2	12				
	Total Hours			29	22			

Students are required to undergo 15 hours training / field visit/ workshop in relevant field during semester.

N- No	CIE – Continuous internal evaluation
Y – Yes	PSEE – Practical semester end examination including ITD, Dissertation, Industrial project, Industrial training etc...

Course Title	INSTALLATION & MAINTENANCE OF ELECTRICAL EQUIPMENTS
Course Code	DEE519
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

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

- **Apply** the procedure of unloading of electrical equipment's/machines.
- **Commissioning** test and analysis of test results of various electrical equipment's/machines.
- **Maintain** various electrical equipment's/machines.
- **Trouble** shoots various electrical equipment's/machines.
- **Carryout** and testing of earthing system.
- **Apply** electrical accidents and safety rules during maintenance.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	Inspection and Installation of Machine Inspection on Arrival of Machine ,Procedure for Inspection of an electrical machine before installation ,Generalized Procedure of Installation of Electrical machine, General requirement for Electrical Installation According to Indian Electricity Rules, Safety precautions to be observed.	7
2	Commissioning and Testing Standard procedure at the time of Installation of Overhead Lines ,Standard procedure at the time of Installation of Electrical statics and rotating machine, Commissioning Testing and of Overhead Distribution Lines ,Commissioning and testing of cables ,Commissioning and testing of Motor, Commissioning of three phase Transformer ,Different types of electrical and mechanical tests ,Measurement of Insulation Resistance (I.R.).	6

3	<p>Maintenance Fundamental of Maintenance, maintenance Introduction ,Advantages of Preventive maintenance ,Classification of Preventive maintenance ,Breakdown Maintenance ,Maintenance schedules of different types of electrical machines (Rotating and static) and equipment, transmission line, circuit breakers and cables ,Safety rules applicable for preventive maintenance and breakdown Maintenance, Tools/equipment's required for maintenance of domestic appliances ,Safety rules observed during maintenance of domestic appliances</p>	8
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SECTION II

4	<p>Trouble Shooting Definition of trouble shooting ,Causes of faults and types of faults ,Trouble shooting charts for electrical equipment and machines ,Tools and equipment used in trouble shooting and repair ,Servicing procedure for electrical equipment and list of the servicing.</p>	8
5	<p>Earthing Purpose of earthing, Factors affecting the earth resistance Points to be considered at the time of Installation of earthing, Types of Earth Electrode ,Methods of earthing, Procedure for measurement of earth resistance, Methods used for reducing earth resistance.</p>	7
6	<p>Electrical Accidents and Safety Introduction ,Causes of electrical accidents, Preventive measures-How to deal with the Electrical Accidents, Electrical Shocks, Treatment of Electrical Shocks, Importance of "permit to work" in power station, Recommend safety precaution against electrical shocks, Artificial respiration of an electrocuted person.</p>	6

Reference Books:

1. Tarlok Singh, Installation Commissioning & Maintenance Of Electrical Equipments^{1st} Edition, S. K. Kataria & Sons, 2013.
2. S. Rao, Testing Commissioning Operation & Maintenance Of Electrical Equipments, 6th Edition, Khanna Publishers, New Delhi, 2010.
3. Wadhwa C.L., Electrical power system, 6th Edition, New Age international Publications, 2012.
4. Paul Gill, Electrical Power Equipment Maintenance & Testing, 2nd Edition ,CRC Press, 2013.

List of Experiments:

1. Prepare technical report on installation of electrical equipments/machines.
2. Define Tools & Accessories used for installation, maintenance & repair work.
3. Measure insulation resistance of a winding/cables/wiring installation using Megger.
4. Prepare test report of Motor after commissioning.
5. Prepare test report of Transformer after commissioning.
6. Measure earth resistance of installation of building/domestic wiring and Appliances.
7. Prepare plate/pipe earthing as per IS and measure the earth resistance
8. Prepare poster/chart for Trouble shooting of a Transformer.
9. Prepare poster/chart for Trouble shooting of a Motor.
10. Use of following instruments
 - (a)Megger (b)Clip on meter
 - (c)Earth tester
 - (d)Phase sequence indicator
 - (e)Growler
11. Read and interpret I.E. rules pertaining to safety.
12. Prepare a report in case of an electrical accident.

Course Title	ELECTRICAL SWITCHGEAR & PROTECTION
Course Code	DEE520
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

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

- **Identify** various types of faults in Power system.
- **Maintain** different types of circuit breakers in power system.
- **Maintain** different types of relays in power system.
- **Protect** transformer, alternator and motor.
- **Protect** power system against over voltages.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	Introduction to Protection System Necessity of protection system , Faults in Power system ,Fault statics ,Main types of faults ,Short circuit current and its harmful effects on power system ,Source of fault ,Fault clearing process ,Basic requirements of protection system ,Protection zones ,Types of protection	6
2	Protective Relays Concept of protective relay and its selection ,Basic terminology of protective relay ,TSM & PSM ,Operating principle of protective relays ,Classification of relays ,Electromagnetic relays ,Electromagnetic attraction relays ,Electromagnetic induction relays ,Over current relays ,Instantaneous over current relay ,Inverse time over current relay ,Definite time over current relay ,Inverse definite minimum over current relay	7
3	Circuit Breaking Fuse:- Terminology, Advantages, Disadvantages of fuses ,Fuse element materials ,Various definitions related to fuse ,Types of fuses and their applications	8

	<p>C.B.:-Operating principle of C.B., Arc Phenomena, Arc extinction ,Important terms related to C.B., Classification of C.B., Oil circuit breaker, Air circuit breaker, SF_6 circuit breaker, Vacuum circuit breaker, Construction, working, advantage, disadvantages, application of C.B.</p>	
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SECTION II

4	<p>Over voltage protection Introduction ,Surge Voltage ,Internal and External Causes of over voltages ,Mechanism of lightning ,Types of lightning strokes ,Types of Lightning arrester, its principle, construction and application ,Surge absorber</p>	8
5	<p>Protective Transformer Necessity of Protective Transformers ,Terms related to C.T. & P.T. ,Principle and working of Protective Transformers ,Classification, construction of C.T. & P.T., Vector diagram of protective transformer Capacitor Voltage transformer (CVT)</p>	4
6	<p>Static Relays & Numerical relay Need of static relays ,Essential components of static relay ,Comparison with electromagnetic relay ,Advantages, disadvantages of static relay, Classification of static relays ,Static Over current relay ,Microprocessor based relay</p>	3
7	<p>Protection of induction motor, transformer and generator</p> <p>Protection of Induction motor</p> <ul style="list-style-type: none"> • Overload protection of IM • Protection against single phasing <p>Protection of Transformer</p> <ul style="list-style-type: none"> • Differential protection of 3 winding transformer • Restricted earth fault protection <p>Protection of generator</p> <ul style="list-style-type: none"> • Over current and earth fault protection of generator • Rotor earth fault protection • Loss of field protection 	6

Reference Books:

1. V.K. Mehta, "Principles of power system" S. Chand & Co., New Delhi, 2011.
2. J.B. Gupta, "Switchgear and Protection", third edition ,S.K.Kataria& sons, New Delhi, 2013
3. Sunil S. Rao, " Switchgear Protection and Power systems", thirteenth edition, Khanna Publishers, Delhi, 2012
4. A.Chakrabarti, Soni, Gupta, Bhatnagar, "A Textbook on Power system Engineering", second edition, Dhanpat Rai & co., 2012
5. A.K. Sawhney, " A Course in Electrical and electronic Measurements and instruments", 19th edition, Dhanpat Rai & co., 2012

List of Experiments:

1. Draw line diagram of power system & study the protection zone.
2. To perform over current –time current relay.
3. To perform thermal overload relay.
4. To study the static relay.
5. To study the numerical relay.
6. To demonstrate C.T. & P.T.
7. To study various types of Fuse & C.B.
8. To demonstrate various fuses
9. To demonstrate various circuit breakers.
10. To perform the distance protection for generator.
11. To study bus bar protection.
12. To study the types of lightning arresters.
13. To study of Insulation co-ordination & volt- time characteristic.

Course Title	ELECTRICAL POWER SYSTEM-2
Course Code	DEE521
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

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

- **Discriminate** the equipment used in substation.
- **Calculate** the voltage to be maintained at the feeding end of a distributor loaded at two points along its length.
- **Discriminate** different type of Cable according to voltage rating.
- **Draw** bus bar arrangement for 400/132KV substation.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	Transmission of Power Structure of power system, Need of Transmission system, Transmission systems, DC Two wire, Single phase two wire ,Single phase three wire	4
2	Transmission line parameters Skin effect, Proximity effect, Ferranti effect, Corona, Differentiate between efficiency and regulation of a transmission line, Types of Conductors.	7
3	Bus Bar and Interconnected systems How Bus bar is important for transferring power, Types of bus – bar arrangement with sketches, Advantage of interconnected system, Importance and functions of the load dispatch center, Importance of smart grid	4

4	Power factor improvement & Tariff Concept of P.F., Method of improving P.F., Types of Tariff & its calculation (as per current norms of electricity board) Example of Tariff	6
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SECTION II

5	Distribution system Classification of Distribution system, Types of AC distribution, various connection schemes of the distribution system, Solve simple numerical problems regarding different feeder point	7
6	Sub-station Function of Substation, Classification of Substation, Types of equipment used in substation, Switchyard equipment, Control room equipment	4
7	Cables General construction of Cable, insulating materials used for cables, Classification of Cable normally used in distribution system, Types of cable and their voltage ratings	6
8	Flexible A.C. Transmission system (FACTS) Basic Know how of the FACTS Devices, Requirements of FACTS devices Types of FACTS Devices	4

Reference Books:

1. V.K. Mehta, "Electrical power system" 2nd Edition, S.Chand & co., New Delhi, 2002 Reprint 2013.
2. S.L.Uppal, "Electrical power" , 6th edition Khanna Publisher 1975 reprint 2006
3. B.R.Gupta, "power system analysis and design" S. Chand & Co., New Delhi, 30th edition 2010.
4. M.V Despande "Electrical power system design" Tata McGraw-Hill Education, 26th reprint 2006

List of Experiments:

1. To prepare a report on different types of connectors used in the transmission lines.
2. State the difference between skin effect, proximity effect, Ferranti effect and corona in power system.
3. State the performance characteristics of a typical dc distribution system (radial configuration).
4. To make a chart of low power factor effect on various industries.
5. To prepare a report after studying distribution system of a residential colony.
6. To prepare case study report of tariff of residential electrical bill.
7. To calculate the voltage to be maintained at the feeding end of a distributor loaded at two points along its length.
8. To draw bus bar arrangement for 400/132KV substation.
9. To discriminate the equipment used in substation.
10. Make Prepare technical report after visiting a substation.
11. Interpret and explain the given Blue Print of a Sub-Station
12. Discriminate different type of Cable according to voltage rating.
13. Prepare a report about types of cables used in distribution system after visiting nearby cable suppliers/industries or otherwise with the help of internet.
14. To distinguish different FACTS device used in Power system.

Course Title	ELECTRICAL WIRING, ESTIMATING, COSTING& CONTRACTING
Course Code	DEE516
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 1
	Total : 5

Course Learning Outcomes

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

- **Prepare** an estimate of quantity and cost of the material for an electrical project.
- **Prepare** detail estimate and costing of Residential and commercial Electrical Installations.
- **Test** Residential, commercial and Industrial Electrical Installation.
- **Prepare** detail estimate and costing of a transmission line/Overhead and underground distribution project.
- **Prepare** estimates for repairs and maintenance of electrical devices and equipment.
- **Prepare** wiring related projects and calculate total cost of wiring system.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	Electrical Wiring with IE rules. <ul style="list-style-type: none"> • Introduction, Define types of wires, Different types of wiring system and wiring procedure ,Comparison of different types of wiring. Different types and specifications of wiring materials, Accessories and wiring tools , Prepare I.E. rules for wiring, including Electricity supply act-2003 , Prepare different types of wiring circuits. 	8
2	Elements of Estimating, Costing and Contracting <ul style="list-style-type: none"> • Introduction, Definition of Estimation, Costing and Contracting ,Classify different types of estimation and estimation tools, Explain the types of contracts and contractors ,Define Overhead and service charges. 	5

3	<p>Estimating and Costing of Domestic and Industrial Wiring</p> <ul style="list-style-type: none"> Introduction, Layout and wiring diagram for residential building, commercial building and industrial area.(As per IE rules) ,Load calculation and selection of wires/cables for all types of wiring. (As per IE rules), Selection of protection system and earthing for all types of wiring. (As per IE rules. Estimating and costing of all materials and accessories require for residential building, commercial building and industrial area. (As per IE rules.) Important of Electrical Safety rules for installation of all types of wiring. 	8
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SECTION II

4	<p>Service Connection. (Domestic, commercial and Industrial area.)</p> <ul style="list-style-type: none"> Introduction, Prepare Survey work sheet for domestic, commercial and industrial service connection, List of materials and accessories along with specifications required for all types of service connection ,Estimating and costing of materials and accessories as per requirement, Important of I.E. rules for pertaining to above wiring, Important of electrical safety rules for above wiring. 	10
5	<p>Overhead and Underground Distribution System.</p> <ul style="list-style-type: none"> Introduction, Sketch layout of overhead and underground distribution system, Estimate quantity of material, accessories and cost required for overhead and underground distribution system ,I.E. rules and safety rules preparing to overhead and underground distribution system. 	6
6	<p>Principles of Contracting and Tender notices.</p> <ul style="list-style-type: none"> Introduction, Prepare Terms, conditions, and types of contract system, Define Tender, tendering procedure and preparation of simple tender, Prepare Terms and conditions of tender, procedure for inviting and scrutinizing of tender, Define Earnest Money Deposit, Security Deposit and S.O.R. 	5

Reference Books:

1. Dr.S.L.Uppal of Electrical Wiring, Estimating and Costing 6th addition by Khanna Publishers-2013.
2. K.B.Raina& S.K.Battacharya of Electrical Design Estimating and Costing 1st addition by new age international (p) limited. Publishers-2014.
3. Surjit singhby of Electrical estimating & costing 2nd addition By Khanna Publishers-1997
4. A.K.Sawhney of Electrical & Electronics measurement & instrumentation 3rd addition By Khanna Publishers-2012.

List of Experiments:

1. To prepare Electric wiring and its list materials and accessories, Tools appropriate as per Requirement.
2. To carryout following wirings.
 - Tube light wiring
 - Stair case wiring
 - Go down wiring
 - Parallel loop wiring
3. To prepare a tender notice for given work.
4. To survey of service connection.
5. Different method of providing service connection & comparison between Overhead and underground service connection.
6. I.E. rules for electrical wiring as per 2003 act.
7. Prepare Layout, load calculation, Estimation and costing of domestic installation. (Residential building, laboratory room or Drawing hall etc)
8. Prepare Layout, load calculation, Estimating and costing of industrial installation. (work shop, agriculture, flour mill etc)
9. Prepare Layout, Estimating and costing of overhead service connection & Underground service connection.
10. Prepare Layout, Estimating and costing of overhead, 440 V, 3-phase, 4 wire or 3 wire distribution line and Estimating and costing of underground, distribution line.
11. Project work in Group (3 to 8 students per group) and topics are based on Electrical wiring system.

Course Title	Green Energy Technologies
Course Code	DEE522
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

At the end of the session student will be able:

- Understand the basics of solar photovoltaic.
- Identify the components of Wind Energy conversion system.
- Identify the site selection of solar, wind, tidal and geothermal power plant.
- Compare different types of wind mill.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	Energy scenario and development Energy Sources: classification of energy sources, Importance of Non-conventional energy resources, Consumption trend of energy resources Salient feature of Green energy sources, Energy scenario in India.	5
2	Solar radiation and Photovoltaics Solar radiation: extra-terrestrial and terrestrial, Solar radiation measuring instrument, Solar cell classification, Solar cell characteristics Working principle of solar photovoltaic (PV) plants, Site selection of solar photovoltaic (PV) plants, Solar PV Applications, Installation and Maintenance procedure of typical Solar PV Power plant, Government policy for installation of Solar PV Power plants	12
3	Tidal Power Plant Components of tidal power plants, Site selection of tidal power plants Tidal power Generation, Advantages and disadvantages of tidal power plants	4

SECTION II

4	Wind resource and Aerodynamics of wind turbine Nature of wind energy, Current status and future prospects, Measurement of wind: Ecological indicator, Anemometers and wind directions Airfoil, lift and drag characteristics, Wind turbine Aerodynamics, Power coefficient and tip speed ratio characteristics.	6
5	Wind Energy Basic principle of Wind energy conversion system, Basic component of wind energy conversion system, Types of wind mills, Effect of wind speed on power Generation, Wind energy potential and site selection, Application of wind energy, Advantages and disadvantages of Wind energy, Wind energy programme in India	10
6	Geothermal power Plant Geothermal resources, Geothermal power generation, Site selection of tidal power plants, Advantages and disadvantages of tidal power plants.	5

Reference Books:

1. Generation and Utilization of electrical Energy by S. sivanagaraju – Pearson publication.
2. Energy Technology by S.Rao –Khana Publication
3. Non-conventional energy resources by B H Khan Publication The Tata McGraw Hill Companies, New Delhi, 2008
4. Goswami DY. Kreith F. Kreider JF. Principles of Solar Engineering, Taylor & Francis, 1999

List of Experiments:

1. To study the basic classifications of Solar PV system.
2. To study on the different types of Solar cells.
3. To demonstrate the I-V and P-V characteristic solar module.
4. To demonstrate of V-I characteristics & P-V characteristics of a solar PV module by series & parallel connection.
5. To study the different types of wind turbine system.
6. To study about different components of wind turbine.
7. Prepare technical report of visit to a nearby Solar PV station (otherwise from Internet)
8. Prepare technical report of visit to a nearby Wind energy (otherwise from Internet).
9. Prepare Technical report on Non-convectional power generation of Gujarat state.
10. To study of tidal power plant
11. To study of geothermal power plant
12. **PROJECT:** Design of a working model of solar charger

Course Title	ELECTRICAL POWER SYSTEM-2	
Course Code	DEE521	
Course Credit	Lecture	: 3
	Practical	: 1
	Tutorial	: 0
	Total	: 4
Course Learning Outcomes		
<p>At the end of course, students will be able to:</p> <ul style="list-style-type: none"> • Discriminate the equipment used in substation. • Calculate the voltage to be maintained at the feeding end of a distributor loaded at two points along its length. • Discriminate different type of Cable according to voltage rating. • Draw bus bar arrangement for 400/132KV substation. 		
Detailed Syllabus		
SECTION I		
Module No.	Topics	No. of Sessions
1	Transmission of Power Structure of power system, Need of Transmission system, Transmission systems, DC Two wire, Single phase two wire, Single phase three wire	4
2	Transmission line parameters Skin effect, Proximity effect, Ferranti effect, Corona, Differentiate between efficiency and regulation of a transmission line, Types of Conductors.	7
3	Bus Bar and Interconnected systems How Bus bar is important for transferring power, Types of bus – bar arrangement with sketches, Advantage of interconnected system, Importance and functions of the load dispatch center, Importance of smart grid	4

4	Power factor improvement & Tariff Concept of P.F., Method of improving P.F., Types of Tariff & its calculation (as per current norms of electricity board) Example of Tariff	6
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SECTION II

5	Distribution system Classification of Distribution system, Types of AC distribution, various connection schemes of the distribution system, Solve simple numerical problems regarding different feeder point	7
6	Sub-station Function of Substation, Classification of Substation, Types of equipment used in substation, Switchyard equipment, Control room equipment	4
7	Cables General construction of Cable, insulating materials used for cables, Classification of Cable normally used in distribution system, Types of cable and their voltage ratings	6
8	Flexible A.C. Transmission system (FACTS) Basic Know how of the FACTS Devices, Requirements of FACTS devices Types of FACTS Devices	4

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- V.K.Mehta, "Electrical power system" 2nd Edition, S.Chand & co., New Delhi, 2002 Reprint 2013.
- S.L.Uppal, "Electrical power" , 6th edition Khanna Publisher 1975 reprint 2006
- B.R.Gupta, "power system analysis and design" S. Chand & Co., New Delhi, 30th edition 2010.
- M.V Despande "Electrical power system design" Tata McGraw-Hill Education, 26th reprint 2006

List of Experiments:

15. To prepare a report on different types of connectors used in the transmission lines.
16. State the difference between skin effect, proximity effect, Ferranti effect and corona in power system.
17. State the performance characteristics of a typical dc distribution system (radial configuration).
18. To make a chart of low power factor effect on various industries.
19. To prepare a report after studying distribution system of a residential colony.
20. To prepare case study report of tariff of residential electrical bill.
21. To calculate the voltage to be maintained at the feeding end of a distributor loaded at two points along its length.
22. To draw bus bar arrangement for 400/132KV substation.
23. To discriminate the equipment used in substation.
24. Make Prepare technical report after visiting a substation.
25. Interpret and explain the given Blue Print of a Sub-Station
26. Discriminate different type of Cable according to voltage rating.
27. Prepare a report about types of cables used in distribution system after visiting nearby cable suppliers/industries or otherwise with the help of internet.
28. To distinguish different FACTS device used in Power system.

Course Title	ELECTRICAL TRACTION AND CONTROL
Course Code	DEE517
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

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

- **Distinguish** different traction systems and latest trends in traction systems
- **Differentiate** services of traction system based on speed time curve
- **Control** different types of traction motors
- **Use** various traction system auxiliaries.
- **Explain** the distribution system of a traction system.

Detailed Syllabus

SECTION I

Module No.	Topics	No. of Sessions
1	TRACTION SYSTEMS Introduction, Different systems of traction, System of electrical traction, System of track electrification, Comparison between DC and AC system of railway electrification from the point of view of main line and suburban line railway services	6
2	TRAIN MOVEMENT Introduction, Mechanics of train movement, Train effort for propulsion of train, Power output from the driving axles, Energy output from driving axles, Dead weight, accelerating weight and adhesive weight	5
3	ELECTRIC TRACTION MOTOR Introduction, General features of traction motor, Operating characteristics of dc motors, DC series motor, DC shunt motor, AC series motor, Three phase induction motor, Linear induction motor, Rating and ventilation.	4

4	ELECTRIC LOCOMOTIVES Introduction, Current collecting systems, Current collectors for overhead systems, DC track electrification ,AC track electrification ,Block diagram of an AC electric locomotive ,Major substation equipment ,Booster transformer	6
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SECTION II

5	SPECIFIC ENERGY CONSUMPTION AND ITS CALCULUS Determination of specific energy output using simplified speed-time curve, Factor affecting energy consumption, Factors affecting specific energy consumption of an electric train operating on a given schedule speed Examples of specific energy consumption of an electric train	7
6	CONTROL OF TRACTION MOTOR Introduction, Starting and speed control of dc traction motors, Practical requirements, Transition methods, Drum controller, Contactor type controller ,Metadyne control ,Thyristor control of traction motors ,Speed control and starting of single phase series motors ,Speed control and starting of three phase induction motors	8
	Breaking of traction system Introduction, Electrical breaking Mechanical breaking, Magnetic track breaks, Auxiliary equipment	6

Reference Books:

5. Utilization of electrical power and electrical traction by J B Gupta Publication S K Kataria & sons, New Delhi ,2012
6. Modern Electric Traction By H. Partab Publication Dhanpat Rai and Sons, New Delhi, 2012.
7. Electric Traction By J. Upadhyay & S. N. Mahindra Publication Allied Publishers Ltd., New Delhi, 2012.
8. Utilization of electrical power and electrical traction by G C Garg Publication Khanna Publishers Delhi, 2012.

List of Experiments:

1. Prepare report on the various traction systems in Indian railways.
2. Solve numerical on speed time curves.
3. Solve numerical on specific energy consumption.
4. Justify the use of D. C. Series motor as traction motor.
5. Study the energy recovered using regenerative braking
6. Draw sketch of the current collecting equipment's
7. Study of layout of D. C. locomotive and diesel locomotive
8. Study of power diagram of A.C. locomotive and its equipment
9. Study of major equipment's in AC traction substations.
10. Use electronic control of traction motor.
11. Prepare different between linear induction motor and DC motor
12. To perform Speed control and starting of single phase series motors
To perform Speed control and starting of three phase induction motors

Course Title	INDUSTRIAL ELECTRONICS
Course Code	DEC413
Course Credit	Lecture : 3
	Practical : 1
	Tutorial : 0
	Total : 4

Course Learning Outcomes

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

- **Understand** the structure & **analyze** characteristics of Power semiconductor devices & working of Controlled Rectifier.
- **Classify** various choppers and **observe** with different firing angle.
- **Classify** various inverters and describe its construction, working and **observe** the output.
- **Understand** the block diagram and basics of automation sensors, systems.
- **Use** of Power electronics application in field.

Detailed Syllabus

Module No.	Topics	No. of Sessions
SECTION I		
1	POWER SEMICONDUCTOR DEVICES Introduction. Structure & operation of Thyristors (SCR). V-I Characteristics of Thyristors (SCR). The two transistor model of Thyristors (SCR). Turn on methods of Thyristors. Thyristors firing circuits using UJT. Turn off methods: Class A, Class B, Class C & Class D.	6
2	POWER SEMICONDUCTOR DEVICES Power semiconductor devices: DIAC, TRIAC, GTO and SIT, (Device Structures and Characteristics only).	3
3	CONTROLLED RECTIFIERS Principle of phase controlled converter. (for followings consider resistive load, inductive load & freewheeling effect) Single phase half wave controlled rectifier. Single phase full wave controlled rectifier.	6

	Single phase half controlled bridge rectifier.	
4	<p>CHOPPER</p> <p>Introduction of chopper. Principle of operation of step down dc chopper. Principle of operation of step up dc chopper. Different types of choppers: Class A, Class B, (circuits & characteristics). Jone's chopper. Morgan's chopper</p>	6

SECTION II

5	<p>INVERTORS</p> <p>Introduction. Classification of inverters. Single phase half bridge inverter. Single Phase full bridge inverter. PWM half bridge & full bridge inverter</p>	7
6	<p>AUTOMATION SENSORS & SYSTEM</p> <p>Introduction & advantage of automation. Basics of electrical drives & Terms used in electrical drives. Block diagram of AC & DC drive systems. Basics of Human Machine Interface. Basic of Strip sensor. Block diagram of PID controller. Block diagram & Understanding of PLC-SCADA system. Proximity sensors: capacitive & inductive.</p>	7
7	<p>POWER ELECTRONIC APPLICATIONS</p> <p>Introduction. Uninterruptible power supply. Switch mode power supply. High voltage D.C. Transmission. Electronic lamp ballast. Battery charger. Emergency lighting system. Static circuit breaker. Induction heating & Dielectric heating applications</p>	7

Reference Books

1. M. D. Singh and K. B. Khanchandani, A text book of Power Electronics, Tata Mc Graw Hill, 2ndEdition.
2. S. K. Bhattacharya, A text book of Industrial Electronics, Tata Mc Graw Hill.
3. G. K. Mithal&Dr.Maneesha Gupta, A text book of Industrial & Power electronics, Khanna Publishers. 19th Edition.
4. M. Rashid, Power Electronics – Circuit, Devices and Applications, Pearson Education. 3rdEdition.
5. Dr P. S. Bimbhra, Power Electronics, Khanna Publishers. 2012 Release Edition

List of Experiments

1. To prepare the V-I characteristics graph for a diode.
2. To prepare the V-I characteristics curve for Uni-Junction transistor (UJT).
3. To test Uni-Junction transistor as a relaxation oscillator.
4. To prepare the V-I characteristics curve of TRIAC.
5. To test & understand phase control using TRIAC.
6. To prepare V-I characteristics curve of SCR.
7. To test & understand forced commutation using SCR.
8. To analyze the characteristics of Synchros.
9. To test & understand the position control using Synchro transmitter & Synchro-receiver.
10. To test & understand Jone's chopper.
11. To test & understand Morgan's chopper.
12. To understand block diagram of PLC system.

Course Title	MINI PROJECT
Course Code	DEE523
Course Credit	Lecture : 00
	Practical : 1
	Tutorial : 00
	Total : 1

Course Learning Outcomes

At the end of the session student will be able:

- **Identify, formulate and analyses** an engineering problem.
- **Acquire** the knowledge of the techniques, skills, and modern engineering tools necessary for engineering practice.
- **Design** the solution of identified problem and Implement the same.
- **Analyze** the outcomes of implemented solution.
- **Present** features of the developed project to the targeted group through written and oral communication.
- **Contribute** in a team in development of technical project.

Project Definition

Project work shall be based on any of the following or other:

- Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
- Experimental verification of principles used in **Electrical Engineering** Applications.
- Product design and development.
- Design and development of laboratory equipment /test rigs.
- Developing computer programs/software.
- Industry based project.
- Industry need based basic survey or Testing or Analysis etc.

Instructional Method and Pedagogy:

- Your project work carried out in 5th semester.
- Preliminary work of project should be completed within project work like Finalization of topic, literature study, methodology etc.
- Each student should maintain log book for the progress of project work. In this book you will keep a log of your weekly work. You must get this signed (and dated) by your supervisor every week. It will be handed in with your final report, and should cover the following headings:

- o Progress (from previous week)
- o Problems & Queries,
- o Objectives (for next week)
- o Date of Meeting
- o Sign of Supervisor

- Each student has to prepare and submit the Report with CD-R which will consists of doc & .pdf format of report and .ppt format of presentation at the time of final presentation of project.
- One copy of the report should be submitted to Institute/ Department, one copy to Guide and one copy should remain with each student of the project group. The project term work shall be evaluated based on reviews.
- Oral examination shall be conducted along with final presentation of the project.

Report Layout

1. Cover Page & Title Page
2. Declaration
3. Certificate
4. Project work Approval
5. Acknowledgement
6. Table of Contents
7. Abstract
8. List of Table
9. List of Figures
10. List of Symbols, Abbreviations and Nomenclature
11. Chapters
12. Appendices
13. References

Project Report Preparation Guideline

- Paper must be White Royal Executive Bond, not less than 85 gsm Paper of A4 size.
- Font size type and margins

Details	Font Type	Font size	Spacing
Facing page (cover and first page) – see sample page for details	Times New Roman	14pt bold capitals	Centered (Adjustable spacing)
Chapter headings with chapter number on top	Times New Roman	14pt bold capitals	Centered
Section headings	Times New Roman	12pt bold capitals	Left adjusted
Subsection headings	Times New Roman	12pt. sentence case	Left adjusted
Paragraph headings	Times New Roman	12pt. bold sentence case	Left adjusted
Body of Project report	Times New Roman	12 pt.	Justified and with 1.5 spacing for text and equations
Margins	Left Margin	1.5 inch	To accommodate binding area
	Right Margin	1.25 inch	
	Right Margin	1.25 inch	On pages on which chapter begins
	Bottom	1.25 inch	