DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	ELECTRICAL ENGINEERING	E01	FIFTH (V)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK			THEORY PAPER			HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7443	501	MICROCONTROLLER APPLICATIONS	4	4	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	6	150
2	7444	502	ENERGY CONSERVATION AND AUDIT	4	4	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	5	150
3	7445	511	ELECTRIC VEHICLES OR	3	3	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	4	150
	7446	512	ELECTRIC TRACTION															
4	7447	521	ILLUMINATION PRACTICES OR	3	3	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	4	150
	7448	522	SWITCHGEAR AND PROTECTION															
5	7601	531	RENEWABLE ENERY TECHNOLOGIES OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7602	532	INTERNET OF THINGS															
6			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
7			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
8			WORKSHOP/SEMINAR/VISIT etc	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
9			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
TOTAL				17	17				180	420		19	8	60	90		25	750

NOTE - (1)* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2)** 4-6 Weeks Summer Internship after IV Semester.

(3)***One Credit will be carried forward to the Six semester major project evaluation.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	750

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	MICROCONTROLLER APPLICATIONS
PAPER CODE	:	7443
SUBJECT CODE	:	501
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	02

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain different types of microcontroller based systems.

Course contents:

Unit – I Introduction to Microcontrollers

Evolution of Microcontrollers

Block diagram of Microcomputer, elements of Microcomputer, types of buses

Von Neuman and Harward Architecture

Compare Microprocessor and Microcontrollers

Need of Microcontroller

Family of Microcontrollers and their specifications

Versions of Microcontroller 8951, 89C1051, 89C2051, 89C4051 with their specifications and comparison

Unit – II Architecture of Microcontroller8051

Block diagram of 8051, function of each block

Pin diagram, function of each pin

Concept of Internal memory and External memory (RAM and ROM)

Internal RAM structure

Reset and clock circuit

Various registers and SFRs of 8051

Unit– III 8051 Instruction Set and Programs

Overview of 8051 instruction set

Various addressing modes

Classification of instructions

Data transfer instructions

Arithmetic instructions

Logical instructions

Branching instructions

Bit manipulation instructions

Stack, subroutine and interrupt related instructions

Programs based on above instructions.

Unit– IV Assembly Language Programming

Software development steps

Software development tools like Editor, Assembler, Linker, Loader and Hex converters.

Role of various files created at various levels in running a Assembly program using simulators like RIDE or KEIL.

Various directives of Assembly language programming

Programs using directives.

Unit– V 8051 Internal Peripherals and Related Programs

I/O ports- List, diagram, read write operation, instructions and related SFRs

Timers/counters – list, related SFRs, programming modes, operations with diagram.

Serial communication- Basics of serial communication, baud rate, related SFRs, programming modes, operations with diagram.

Interrupts- related SFRs, types, operations with diagram.

Power saving operation- modes, related SFR.

References:

1. Kenneth, Ayala, 8051 Microcontroller Architecture Programming and Application, PHI Learning, New Delhi,ISBN: 978-1401861582
2. Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; MckinlayRoline D., The 8051 Microcontroller and Embedded system, Pearson Education, Delhi, ISBN 978-8177589030
3. Pal, Ajit, Microcontroller Principle and Application, PHI Learning, New Delhi, ISBN13: 978-81-203-4392-4
4. Deshmukh, Ajay, Microcontroller Theory and Application, McGraw Hill., New Delhi, ISBN- 9780070585959
5. Kamal, Raj, Microcontroller Architecture Programming, Interfacing and System Design, Pearson Education India, Delhi, ISBN: 9788131759905
6. Mathur; Panda, Microprocessors and Microcontrollers, PHI Learning, New Delhi, ISBN:978-81-203-5231-5
7. Krishna Kant, Microprocessors and Microcontrollers: Architecture programming and System Design, PHI Learning, New Delhi, ISBN:978-81-203-4853-0

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the salient features of various types of microcontrollers.
b) Interpret the salient features of architype of types microcontrollers IC 8051
c) Maintain the program features of the Microcontroller based application
d) Develop assembly language program
e) Develop programs to interface 8051 microcontrollers with LED/SWITCH

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MICROCONTROLLER APPLICATIONS LAB

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain microcontroller based systems.

Practicals:

1. Interpret details of Hardware kit for Microcontroller and practice to write and execute programs.
2. Identify different menus available in a simulator software RIDE/KEIL and demonstrate their use.
3. Develop and execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data
4. Develop and execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input
5. Develop and execute an Assembly language program for Addition of series of 8 bit nos, 16 bit result and demonstrate outcome for a given input data
6. Develop and execute Assembly language program for addition/subtraction of 16 bit no/multi-byte nos. and demonstrate outcome for a given input data
7. Develop and execute Assembly language program for Block transfer from and to Internal/External memory using directives and demonstrate outcome for a given input data.
8. Develop and execute Assembly language program Largest/smallest of given series of no. from Internal/External memory and demonstrate outcome for a given input data.
9. Develop and execute Assembly language program arrange no in ascending/descending order from Internal/External memory and demonstrate outcome for a given input data.
10. Develop and execute Assembly language program for LED blinking/LED sequences using delay/timer mode.
11. Develop and execute Assembly language program to interface LED with microcontroller.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the salient features of various types of microcontrollers.
b) Interpret the salient features of architype of types microcontrollers IC 8051
c) Maintain the program features of the Microcontroller based application
d) Develop assembly language program
e) Develop program to interface 8051 microcontrollers with LED/SWITCH

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	ENERGY CONSERVATION AND AUDIT
PAPER CODE	:	7444
SUBJECT CODE	:	502
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	01

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Undertake energy conservation and energy audit.

Course contents:

Unit – I Energy Conservation Basics

Energy Scenario: Primary and Secondary Energy, Energy demand and supply,

National scenario.

Energy conservation and Energy audit; concepts and difference

Indian Electricity Act 2001; relevant clauses of energy conservation

BEE and its Roles

MEDA and its Roles

Star Labelling: Need and its benefits.

Unit – II Energy Conservation in Electrical Machines

Need for energy conservation in induction motor and transformer.

Energy conservation techniques in induction motor by:

Improving Power quality.

Motor survey

Matching motor with loading.

Minimizing the idle and redundant running of motor.

Operating in star mode.

Rewinding of motor.

Replacement by energy efficient motor

Periodic maintenance

Energy conservation techniques in Transformer.

Loading sharing

Parallel operation

Isolating techniques.

Replacement by energy efficient transformers. Periodic maintenance.

Energy Conservation Equipment: Soft starters, Automatic star delta convertor, Variable Frequency Drives, Automatic p. f. controller (APFC), Intelligent p. f. controller (IPFC)

Energy efficient motor; significant features, advantages, applications and limitations.

Energy efficient transformers, amorphous transformers; epoxy Resin cast transformer / Dry type of transformer.

Unit– III Energy conservation in Electrical Installation systems

Aggregated Technical and commercial losses (ATC); Power system at state, regional, national and global level.

Technical losses; causes and measures to reduce by.

a) Controlling I^2R losses.
b) Optimizing distribution voltage
c) Balancing phase currents
d) Compensating reactive power flow

Commercial losses: pilferage, causes and remedies

Energy conservation equipment: Maximum Demand Controller , kVAR Controller, Automatic Power Factor controller(APFC)

Energy Conservation in Lighting System

a) Replacing Lamp sources.
b) Using energy efficient luminaries.
c) Using light controlled gears.
d) Installation of separate transformer / servo stabilizer for lighting.
e) Periodic survey and adequate maintenance programs.

Energy Conservation techniques in fans, Electronic regulators.

Unit– IV Energy conservation through Cogeneration and Tariff

Co-generation and Tariff; concept, significance for energy conservation

Co-generation

Types of cogeneration on basis of sequence of energy use (Topping cycle, Bottoming cycle)

Types of cogeneration basis of technology (Steam turbine cogeneration, Gas turbine cogeneration, Reciprocating engine cogeneration).

Factors governing the selection of cogeneration system.

Advantages of cogeneration.

Tariff: Types of tariff structure: Special tariffs; Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff.

Application of tariff system to reduce energy bill.

Unit– V Energy Audit of Electrical System

Energy audit (definition as per Energy Conservation Act)

Energy audit instruments and their use.

Questionnaire for energy audit projects.

Energy flow diagram (Sankey diagram)

Simple payback period, Energy Audit procedure (walk through audit and detailed audit).

Energy Audit report format.

References:

1. Guide Books No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
2. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN*: 978-*0195606539
4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
6. Mehta ,V. K., Principles of Power System, S. Chand &Co.New Delhi, 2016, ISBN 9788121905947
7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria&Sons,New Delhi ISBN-13: 9789350141014.
8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.
9. Chakrabarti, Aman, Energy Engineering And Management, e-books Kindle Edition

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret energy conservation policies in India.

b) Implement energy conservation techniques in electrical machines.

c) Apply energy conservation techniques in electrical installations.

d) Use Co-generation and relevant tariff for reducing losses in facilities.

e) Undertake energy audit for electrical system.

ENERGY CONSERVATION AND AUDIT LAB

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Undertake energy conservation and energy audit.

Practicals:

1. Identify star labelled electrical apparatus and compare the data for various star ratings.
2. Determine the '% loading' of the given loaded Induction motor.
3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode.
4. Use APFC unit for improvement of p. f. of electrical load.
5. Compare power consumption of different types of TL with choke, electronic ballast and LED lamps by direct measurements.
6. Determine the reduction in power consumption by replacement of lamps in a class room / laboratory.
7. Determine the reduction in power consumption by replacement of Fans and regulators in a class room / laboratory.
8. Collect electricity bill of an industrial consumer and suggest suitable tariff for energy conservation and its impact on energy bill.
9. Collect electricity bill of a commercial consumer and suggest suitable tariff for conservation and reduction of its energy bill.
10. Collect electricity bill of a residential consumer and suggest suitable means for conservation and reduction of the energy bill.
11. Estimate energy saving by improving power factor and load factor for given cases.
12. Prepare a sample energy audit questionnaire for the given industrial facility.
13. Prepare an energy audit report (Phase-I)
14. Prepare an energy audit report (Phase-II)
15. Prepare an energy audit report (Phase-III)

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret energy conservation policies in India.
b) Implement energy conservation techniques in electrical machines.
c) Apply energy conservation techniques in electrical installations.
d) Use Co-generation and relevant tariff for reducing losses in facilities.
e) Undertake energy audit for electrical system.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	ELECTRIC VEHICLES
PAPER CODE	:	7445
SUBJECT CODE	:	511
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric vehicles

Course contents:

Unit – I Introduction to Hybrid Electric Vehicles

Evolution of Electric vehicles

Advanced Electric drive vehicle technology Vehicles-Electric vehicles (EV), Hybrid Electric drive (HEV), Plug in Electric vehicle (PIEV),

Components used Hybrid Electric Vehicle

Economic and environmental impacts of Electric hybrid vehicle

Parameters affecting Environmental and economic analysis

Comparative study of vehicles for economic, environmental aspects

Unit – II Dynamics of hybrid and Electric vehicles

General description of vehicle movement

Factors affecting vehicle motion- Vehicle resistance, tyre ground adhesion, rolling resistance, aerodynamic drag, equation of grading resistance, dynamic equation

Drive train configuration, Automobile power train, classification of vehicle power plant

Performance characteristics of IC engine, electric motor, need of gear box

Classification of motors used in Electric vehicles

Basic architecture of hybrid drive trains, types of HEVs

Energy saving potential of hybrid drive trains

HEV Configurations-Series, parallel, Series-parallel, complex.

Unit– III DC-DC Converters for EV and HEV Applications

EV and HEV configuration based on power converters

Classification of converters –unidirectional and bidirectional

Principle of step down operation

Boost and Buck- Boost converters

Principle of Step-Up operation

Two quadrant converters; multi quadrant converters

Unit– IV DC-AC Inverter & Motors for EV and HEVs

DC-AC Converters

Principle of operation of half bridge DC-AC inverter (R load, R-L load)

Single phase Bridge DC-AC inverter with R load, R-L load

Electric Machines used in EVs and HEVs, principle of operation, working & control

Permanent magnet motors, their drives, switched reluctance motor

Characteristics and applications of above motors

Unit– V Batteries

Overview of batteries

Battery Parameters, types of batteries

Battery Charging, alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, flywheels

Control system for EVs and HEVs, overview, Electronic control unit ECU

Schematics of hybrid drive train, control architecture

Regenerative braking in EVs

References:

1. A.K. Babu, Electric & Hybrid Vehicles, Khanna Publishing House, New Delhi (Ed. 2018)
2. Fuhs, A. E. Hybrid Vehicles and the Future of Personal Transportation, CRC Press,
3. Gianfranco, *Electric and Hybrid Vehicles:* Power Sources, Models, Sustainability, Infrastructure And The Market, Pistoia Consultant, Rome, Italy,
4. Ehsani, M. *Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design*, CRC Press
5. Husain, I. *Electric and Hybrid Electric Vehicles*, CRC Press
6. Chan C. C. and K. T. Chau, *Modern Electric Vehicle Technology*, Oxford Science Publication,
7. Lechner G. and H. Naunheimer, *Automotive Transmissions: Fundamentals, Selection,Design and Application*, Springer
8. Rashid, M. H. *Power Electronics: Circuits, Devices and Applications*, 3rd edition, Pearson,
9. Moorthi, V. R. *Power Electronics: Devices, Circuits and Industrial Applications*, Oxford University Press
10. Krishnan, R. *Electric motor drives: modelling, analysis, and control*, Prentice Hall
11. Krause, O. P. ; C. Wasynczuk, S. D. Sudhoff, *Analysis of electric machinery*, IEEE Press

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the salient features of Hybrid electric vehicles.

b) Interpret the Dynamics of hybrid and Electric vehicles

c) Maintain the DC-DC converters in EV applications.

d) Maintain the DC-AC converters in EV applications

e) Select the batteries for EV applications.

ELECTRIC VEHICLES LAB

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric vehicles

Practicals:

1. Develop block diagram of Electric vehicle and identify parts
2. Case study- Compare minimum four vehicles for economic and environmental analysis
3. Develop schematic diagram of hybrid electric vehicle and identify the components fluorescent lamp.
4. Prepare report on Plug in Electric vehicle by visiting a charging station
5. Inspect and install inverter of given lead acid battery
6. Prepare a report on batteries used from market survey
7. Collect specifications of converters and inverters used for Electric vehicles a single lamp control by two switches
8. Diagnose, repair and maintain battery used in electric vehicle
9. Prepare test procedure for equipment used in Electric vehicle
10. List safety procedures and schedule for handling HEVs and EVs.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the salient features of Hybrid electric vehicles.
b) Interpret the Dynamics of hybrid and Electric vehicles
c) Maintain the DC-DC converters in EV applications.
d) Maintain the DC-AC converters in EV applications
e) Select the batteries for EV applications.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	ELECTRIC TRACTION
PAPER CODE	:	7446
SUBJECT CODE	:	512
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric traction systems.

Course contents:

Unit – I Basics of Traction

General description of Electrical Traction system in India.

Advantages and Disadvantages of Electric Drive, Diesel Electric Drive, Battery Drive

Problems associated with AC traction System and remedies for it.

Voltage balance, current balance, production of harmonics, induction effects.

Metro rail system, features

Unit – II Power Supply Arrangements

Constituents of supply system:-

- Substation: layout, list of equipment and their functions
- Feeding post: list of equipment and their functions
- Feeding and sectioning Arrangements
- Sectioning and paralleling post
- Sub sectioning and Paralleling post
- Sub sectioning post
- Elementary section

Major equipment at substation, Miscellaneous equipment at control post or Switching station

Protection system for traction transformer and 25 kV centenary construction

Unit– III Overhead Equipment

Different types of overhead equipments

Pentagonal OHE Centenary Construction

Different Types of Centenary according to speed Limit

OHE Supporting Structure, Cantilever assembly diagram

Overhead system- Trolley collector, Bow collector, Pantograph Collector

Types and construction of pantograph

Unit– IV Electric Locomotive

Classification and Nomenclature of Electric Locomotive

Block diagram of AC locomotive

Power Circuit of AC Locomotive

Equipment (List and Function only) used in auxiliary circuit of AC Locomotive

Loco bogie classification according to wheel arrangements

Maintenance of AC systems

Unit– V Traction Motors and Train Lighting

Desirable characteristics of traction motor.

Types of motors used for traction with their characteristics and features

Control of motors used for traction and methods to control

Requirements of braking, types of braking

Electric braking, Regenerative braking

Systems of train lighting, Single battery, double battery parallel block system

SG, HOG, End on generation

Unit VI. Signalling and Supervisory Control

Requirements of signaling systems

Types of signals, track circuits

Advantages of remote control

Systems of remote control, equipment and network

Metro rail-supply systems, advantages, schemes in India

References:

1. G.C. Garg, Utlization of Electric Power & Electric Traction, Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-355) Revised Ed. 2018
2. Gupta J.B., S.K.Kataria and Son, Utilization of Electric power and traction
3. Partab H., Dhanpat Rai and Co,' Art and Science of Utilization of Electrical Energy
4. Partab H., Dhanpat Rai and Co, Modern Electric Traction
5. Suryanarayana N.V., New Age International Publishers, Reprint 2010
6. Open Shaw Taylor, Orient Longman ltd., Utilisation of electrical energy.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the traction layout and its systems

b) Maintain the power supply arrangements.

c) Maintain the function of the overhead equipment for electric traction

d) Maintain the different components of the electric locomotive.

e) Maintain the traction motor and train lighting system

f) Maintain the signalling and supervisory control systems.

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ELECTRIC TRACTION LAB

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric traction systems

Practicals:

1. Dismantle a traction motor
2. Assemble a traction motor
3. Troubleshoot a traction motor
4. Visit electric-traction train lighting system installation, identify components of system and prepare report
5. Visit electric-traction loco shed, investigate working of each section & prepare report
6. Visit to Traction Substation or feeding post (for layout and OHE) and write a report
7. Visit to Railway Station (for signalling and train lighting) and writing a report on visit
8. Draw traction substation Layout on drawing sheet and prepare report
9. Draw Pentagonal OHE Catenary, different Catenaries according to speed limit, OHE supporting structure on drawing sheet and prepare report
10. Draw Power Circuit of AC Locomotive on drawing sheet and prepare report.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Interpret the traction layout and its systems
b) Maintain the power supply arrangements.
c) Maintain the function of the overhead equipment for electric traction
d) Maintain the different components of the electric locomotive.
e) Maintain the traction motor and train lighting system
f) Maintain the signalling and supervisory control systems.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	ILLUMINATION PRACTICES
PAPER CODE	:	7447
SUBJECT CODE	:	521
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design illumination schemes and associated electrification of buildings.

Course contents:

Unit – I Fundamentals of illumination

Basic illumination, Terminology, Laws of illumination

Polar curves, polar curve: its meaning and applications for designing the lamp.

Concept of Photometry, Measurement of illumination

Lighting calculation methods, Watt /m^2 method, Lumens or light flux method, Point to point method

Standards for illumination

Unit – II Types of lamps

Incandescent lamp, ARC lamps – AC and DC arc lamps, Fluorescent lamp

Types of other lamps: Mercury vapour lamp, HPMV lamp, Mercury iodide lamp, Sodium vapour lamp, Halogen Lamps, Ultraviolet Lamps, Neon Lamps. Neon Sign Tubes. Metal halides, HID and Arc lamps

LED lamps, CFL, Lasers

Selection Criteria for lamps

Unit– III Illumination Control and Control Circuits

Purpose of lighting control, and Dimmer, Resistance type Salt water Dimmer

Working principle and operation of Dimmer

Transformer and their types, Dimmer Transformer, Auto transformer dimmer, Two winding transformer dimmer

Electronic Dimmer: working principle and operation

a. Thyristor operated dimmer
b. Triac operated dimmer

Control of Enhance Lighting, Methods used for light control, Control circuits for lamps (refer): ON/OFF control

Control circuits for lamps: single lamp controlled by single switch, two switches.

Single Lamp control by two point method, three point method and four point method,

Unit– IV Illumination for Interior Applications

Standard for various locations of Interior Illumination

Design considerations for Interior location of residences (1/2/3/4 BHK), Commercial, Industrial premises

Illumination scheme for different Interior locations of Residential, Commercial, industrial unit

Unit– V Illumination for Interior Applications

Factory Lighting

Street Lighting (Latest Technology), Flood Lighting

Railway Lighting

Lighting for advertisement /Hoardings/sports lighting, Agriculture and Horticulture lighting, Health Care Centres / Hospitals, Decorating Purposes, Stage Lighting, Aquariums and Shipyards

Special purpose lamps used in photography video films.

References:

1. Lindsey, Jack L., Applied Illumination Engineering, The Fairmont Press Inc.
2. Simons, R. H., Bean, Robert; Lighting Engineering: Applied Calculations, Architectural Press. ISBN: 0750650516.
3. Casimer M Decusatis, Handbook of Applied Photometry, Springer, ISBN 1563964163.
4. Butterworths, Lyons Stanley, Handbook of Industrial Lighting, Butterworths
5. Simpson Robert S, Lighting Control Technology and Applications, Focal Press
6. Kao Chen, Energy Management in Illuminating Systems, CRC Press

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Select relevant lamps for various applications considering illumination levels
b) Select the lighting accessories required for selected wiring scheme.
c) Design relevant illumination schemes for interior applications.
d) Design Illumination schemes for various applications
e) Design Illumination schemes for various outdoor applications.

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ILLUMINATION PRACTICES LAB

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design illumination schemes and associated electrification of buildings.

Practicals:

1. Conduct illumination level assessment in workplace using lux meter.
2. Fit the given lamp in the selected mounting
3. Interpret the polar curves of the given type of lamp and verify it using the lux meter
4. Measure the illumination output of different lamps (Incandescent, Fluorescent, CFL, LED, HPSV, HPMV) and compare it with their wattage.
6. Measure illumination level with and without reflectors used in the various Luminaries.
7. Estimate and compare luminous efficiency of incandescent and compact fluorescent lamp.
8. Prepare light dimmer arrangement using the relevant dimmer type of transformer
9. Identify the given types of dimmer transformer and their parts
10. Build an electronic dimmer – Part I
11. Build another type of electronic dimmer – Part II
12. Build a single lamp control by single switch
13. Build a single lamp control by two switches
14. Build a single lamp control circuit for two-point method
15. Build a lamp control circuit for three-point method
16. Build a lamp control circuit for four-point method.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Select the relevant Illumination levels for various applications
b) Select relevant lamps for various applications
c) Select the lighting accessories required for selected wiring scheme.
d) Design relevant illumination schemes for interior applications.
e) Design Illumination schemes for various applications
f) Design Illumination schemes for various outdoor applications.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	SWITCHGEAR AND PROTECTION
PAPER CODE	:	7448
SUBJECT CODE	:	522
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	01

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain switchgear and protection schemes used in electrical power systems.

Course contents:

Unit – I Basics of Protection

Necessity, functions of protective system.

Normal and abnormal conditions.

Types of faults and their causes.

Protection zones and backup protection

Short circuit fault calculations in lines fed by generators through transformers

Need of current limiting reactors and their arrangements.

Unit – II Circuit Interruption Devices

Isolators- Vertical break, Horizontal break and Pantograph type.

HRC fuses – Construction, working, characteristics and applications.

Arc formation process, methods of arc extinction (High resistance and Low resistance), Arc voltage, Recovery voltage, Re-striking voltage, RRRV.

HT circuit breakers (Sulphur-hexa Fluoride (SF6), Vacuum circuit breaker) - Working, construction, specifications and applications.

L.T. circuit breaker (Air circuit breakers (ACB), Miniature circuit breakers (MCB), Moulded case circuit breakers (MCCB) and Earth leakage circuit breaker (ELCB)) - Working and applications.

Selection of LT and HT circuit breakers (ratings), Selection of MCCB for motors.

Gas insulated switchgear.

Unit– III Protective Relays

Fundamental quality requirements: Selectivity, Speed, Sensitivity, Reliability, Simplicity, Economy.

Basic relay terminology- Protective relay, Relay time, Pick up, Reset current, current setting, Plug setting multiplier, Time setting multiplier.

Protective relays: Classification, principle of working, construction and operation of – Electromagnetic (Attracted armature type, Solenoid type, Watt-hour meter type) relay, Thermal relay. Block diagram and working of Static relay.

Overcurrent relay-Time current characteristics.

Microprocessor based over current relays: Block diagram, working.

Distance relaying- Principle, operation of Definite distance relays.

Directional relay: Need and operation.

Operation of current and voltage differential relay.

Unit– IV Protection of Alternator and Transformer

Alternator Protection

Faults, Differential protection Over current, earth fault, overheating and field failure, protection.

Reverse power protection.

Transformer Protection

Faults, Differential, over current, earth fault, over heating protection, Limitations of differential protection.

Buchholz relay: Construction, operation, merits and demerits.

Unit– V Protection of Motors, Bus-bar and Transmission Line Motor

Faults. Short circuit protection, Overload protection, Single phase preventer**.**

Bus bar and Transmission line

Faults on Bus bar and Transmission Lines.

Bus bar protection: Differential and Fault bus protection.

Transmission line: Over current, Distance and Pilot wire protection.

References:

1. Mehta V. K ;Rohit Mehta, Principles of Power System, S .Chand and Co., New Delhi., ISBN: 978-81-2192-496-2.
1. Rao.Sunil S., Switchgear and Protection, Khanna Publishers, New Delhi, ISBN: 978-81-7409-232-3.
2. Singh, R. P., Switchgear and Power System Protection, PHI Learning, New Delhi, ISBN: 978-81-203-3660-5.
3. Gupta. J. B.. Switchgear and Protection, S. K. Kataria and Sons, New Delhi, ISBN: 978-93-5014-372-8.
4. Veerapan, N.,Krishnamurty, S. R., Switchgear and Protection, S .Chand and Co., New Delhi. ISBN: 978-81-2193-212-7.
5. Ram, Badri; Vishwakarma D. N., Power System Protection and Switchgear, McGraw-Hill, New Delhi. ISBN : 978-07-107774-X

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Identify various types of falts in power system.

b) Select suitable switchgears for different applications.

c) Test the performance of different protective relays.

d) Maintain protection systems of alternators and transformers.

e) Maintain protection schemes for motors and transmission lines.

f) Maintain protection schemes for power system against overvoltages.

SWITCHGEAR AND PROTECTION LAB

Course Code	:	EEPE***
Course Title	:	SWITCHGEAR AND PROTECTION LABORATORY
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PE

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain switchgear and protection schemes used in electrical power systems.

Course contents:

1. Identify various switchgears in the laboratory and write their specifications.
2. Test HRC fuse by performing the load test.
3. Test MCB by performing the load test
4. Dismantle MCCB/ELCB and identify various parts.
5. Dismantle ACB/VCB and identify different parts.
6. Set the plug and time (with PSM, TSM) of induction type electromagnetic relay.
7. Test electromagnetic over-current relay by performing load test.
8. Simulate differential protection scheme for transformer with power system simulation kit.
9. Test the working of the single phasing preventer using a three phase induction motor.
10. Simulate transmission line protection by using the impedance relay/over current relay for various faults. (On transmission line protection simulation Kit).
11. Dismantle Thyrite type arrester and identify different parts.
12. Perform neutral earthing at different substations / locations.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Identify various types of faults in power system.
b) Select suitable switchgears for different applications.
c) Test the performance of different protective relays.
d) Maintain protection systems of alternators and transformers.
e) Maintain protection schemes for motors and transmission lines.
f) Maintain protection schemes for power system against overvoltages.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	RENEWABLE ENERGY TECHNOLOGIES
PAPER CODE	:	7601
SUBJECT CODE	:	531
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
    - To understand bio energy and its usage in different ways.
    - To identify different available non-conventional energy sources.

Course Content:

UNIT-I: Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects ofEnergy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achieve-ments / Applications; Economics of renewable energy systems.

Unit-II: Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrat- ing Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-III: Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Perfor- mance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-IV: Bio-Energy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Etha- nol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-V: Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cy- cles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, BNatarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey &Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course outcomes:

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

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	INTERNET OF THINGS
PAPER CODE	:	7602
SUBJECT CODE	:	532
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Content:

Unit I - Introduction to Internet of Things

- Define the term "Internet of Things"
- State the technological trends which have led to IoT.
- Describe the impact of IoT on society.

Unit II - Design consideration of IoT

- Enumerate and describe the components of an embedded system.
- Describe the interactions of embedded systems with the physical world.
- Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

- Describe the interaction between software and hardware in an IoT device.
- Explain the use of networking and basic networking hardware.
- Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2	internet of Things: A Hands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	SUMMER INTERNSHIP - II
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

SUMMER INTERNSHIP - II

4-6 weeks summer internship after IVth Semester.

It should be undertaken in an Industry only.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN ELECTRICAL ENGINEERING (E01)

SEMESTER V

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00 (ONE CREDIT WILL BE CARRIED FORWARD TO THE VI SEM. MAJOR PROJECT EVALUATION)

MAJOR PROJECT

It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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