Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-V
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)
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Programme: Electrical Engineering **Fifth Semester** **With effect from June 2018**

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19

Semester : V

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 213	Computer Aided Electrical Drawing	--	C	1	0	2	3	0	0	0	50	0	50
2	EE 16 305	Electrical Energy Conservation & Audit#	1	C	4	0	2	6	70#	30#	0	50*	0	150
3	EE 16 306	Switch gear & Protection	1	C	3	0	2	5	70	30	50*	0	0	150
4	EE 16 308	Project & Seminar-I	1	C	0	0	4	4	0	0	0	50*	0	50
5	EE 16 401	Power Electronics &Drives	1	C	4	0	2	6	70	30	50*	0	0	150
6	EE 16 403	Principles of Control System	1	C	3	0	2	5	70	30	0	50*	0	150
7	(Elective) EE 16 404 EE 16 405	a. Illumination Engineering b. Power System Analysis	1	O	3	0	0	3	70	30	0	0	0	100
8	EE 16 406	Industrial Training - I	--	C			4	4	0	0	0	50*	50	100
					18	**0**	**18**		**350**	**150**	**100**	**250**	**50**	
Total Credits								**36**	**Total Marks**					**900**

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
***Indicates assessment by External Examiner. # Indicates on line theory exam.**

Academic Coordinator **HOD (EE)** **Principal**

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 213**		Course Title: **Computer Aided Electrical Drawing**							
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
1	**0**	**2**	**3**	**0**	**0**	**50***	**0**	**0**	**50**

*Indicates External Examiner

RATIONALE:

All the equipments, installations, circuits and other electrical and electronic systems in commercial, power and industrial sector need drawings for their manufacturing, installation, operation and maintenance. A technician working in design and shop floor must possess the skill of reading, interpreting different drawings and simulating electrical and electronics circuit for most of the activities. With the evolution of various computer software's the role of earlier draftsman is now taken over by Computer software. The Computer Aided Drawing (CAD) and simulation (MATLAB / SIMULINK, etc) software will be used to perform various practical exercises in this course. This will enable the students to become competent for working in the fast growing information technology environment by enhancing their computer aided drawing, designing and simulating skills in the field of electrical and electronics engineering.

Course Outcomes:

EE16 213.1	Identify various symbols and notations in electrical and electronics engineering drawings.
EE16 213.2	Interpret drawings, draw interferences and workout other technical details.
EE16 213.3	Draw various electrical and electronics circuits according to standard practices using CAD software.
EE16 213.4	Simulate and test simple electrical and electronics circuits using Simulation software

Course Content Details:

Unit No.	Topics/Subtopics
1	**Introduction to AutoCAD:** 1.1 Concept and terminology. 1.2 Its advantages. 1.3 Loading AutoCAD. 1.4 Creating Opening, Saving and Closing Drawing. 1.5 User Co-ordinate System (UCS) icon. 1.6 Drawing with Precision. 1.7 Drawing Units. 1.8 Linear and angular measurements. 1.9 Accessing help.
2	**Drawing Commands:** 2.1 POINT, LINES, CIRCLE, ARC, ECLIPSE, RECTANGLE, POLYGON, PLINE, HATCH, TEXT, GRADIENT, BOUNDARY, RAY, CONSTRUCTION LINE.

3	**Editing Commands:** 3.1 ERASE, OOPS, MOVE, COPY, MIRROR, CHANGE BREAK, FILLET, ROTATE, SCALE, ARRAY.
4	**Display Commands:** 4.1 Control commands like ZOOM, PAN, VIEW, REDRAW, REGEN, REGENAUTO, etc . 4.2 Drawing with geometrical commands like SNAP & GRID.
5	**Dimensioning:** 5.1 Elements of dimension. 5.2 Drawing linear dimensioning using dimension option. 5.3 MTEXT, TEXT, ANGLE, HORIZONTAL, VERTICAL, ROTATED. 5.4 Drawing aligned dimension. 5.5 Dimensioning arcs and circle. 5.6 Dimensioning angles using quick dimensions. 5.7 Editing dimensions.
6	**Layers:** 6.1 Understanding layers, Creating ,Naming, Assigning colour, LT, LW, Transparency value. 6.2 Using layers, Switching, Changing Layers state, Saving layers state, Changing an exisiting object layer, Making object layer current, Modifying layers.
7	**Plotting and Printing:** 7.1 Preparing a drawing for plotting and printing. 7.2 Doing a draft plot. 7.3 Plotting a drawing. 7.4 Creating a layout in paper space. 7.5 Specifying plot setting preview. 7.6 Plotting and printing.
8	**Draw various electrical circuits using CAD software** 8.1 Draw the cross sectional view of various electrical machines using. 8.2 Draw lighting and power wiring diagram for a given installation
9	**Introduction of Simulation Software:** 9.1 List the steps of using Simulation software . 9.2 Getting started, ending, commonly used blocks, Creating a model, Assigning Variables, Observing Variables during Simulation, Storing/Saving Data, Creating and Masking Sub-systems. 9.3 State the steps to generate graphics and plot Waveform/ response for Analysis. 9.4 Graphics, Plot, sub plot, label, legend etc.
10	**Electrical Circuit Simulation:** 10.1 List the steps of using Simulation software in Electrical engineering 10.2 State the procedure to build simple circuits 10.3 Build, Simulate and test simple electric circuits.
11	**Electronics Circuit Simulation:** 11.1 List the steps of using Simulation software

	11.2 State the procedure to build simple circuits 11.3 Build, Simulate and test simple electronics circuits.

List of Experiments: *(Any 08 Experiments)*

Sr. No.	**Experiment/Assignment**	**Approx Hours**
1	To draw Electrical symbol.	02
2	Draw different types of rectifier circuit using CAD and take print out of : (a)Single phase half wave (b)Single phase full wave (c)Bridge rectifier	02
3	Simulate three resistances in series circuit and find out voltage and current in each resistance.	02
4	Simulate the following circuits and find out voltage and current in each resistance. (a)Two resistances in parallel (b)Resistance and inductor in parallel	02
5	Simulate R-L series circuit and observe voltage wave forms across each component.	02
6	Simulate R-C series circuit and observe voltage wave forms across each component.	02
7	Simulate R-L-C series circuit and observe voltage wave forms across each component.	02
8	Simulate one switch one bulb house wiring diagram circuit.	02
9	Simulate stair case wiring circuit.	02
10	Simulate star connection using resistors and observe voltage current relation of line and phase.	02
11	Simulate delta connection using resistors and observe voltage current relation of line and phase.	02
12	Simulate single phase half-wave rectifier circuit.	02
13	Simulate single phase full-wave rectifier circuit.	02
14	Simulate single phase bridge rectifier circuit.	02
15	Draw the circuit diagram of any electrical engg. practical set up.	02
16	Draw Layout of Substation 11KV/415V	02

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Books:

Sr.No.	*Name of Book*	*Author*	*Publisher*
1	Performance & Design of A.C. Machine	M.G.Say	C.B.S. Publications, New Delhi
2	A Text Book Of Electrical Technology vol-II	B.L.Theraja A.K.Theraja	S. Chand & Co.

3	Electrical Machines	S.K. Bhattacharya	Tata McGraw-Hill Co. New Delhi
4	AutoCAD 2013 for Engineers and Designers.	Sham Tickoo	Dream tech press, New Delhi, Latest edition
5	Mastering AutoCAD 2013 and AutoCAD LT 2013	George Omura	Sybex, New Delhi, Latest edition
6	AutoCAD 2011 & AutoCAD LT 2011	Ellen Finkelstein	Wiley India publication
7	AutoCAD 2010 by Publisher	Paul Whelan	Dreamtech Press
8	AutoCAD for windows express	Tim McCarthy	Narosa.
9	Electrical Wiring estimating and costing	S.L.Uppal	Dhanpat Rai and Sons

List of Software/Learning Websites

1) Open Source Softwares preferred.
2) AutoCAD
3) Circuit maker
4) http://coolcadelectronics.com/coolspice/
5) http://students.autodesk.com/ (register and get free student version of LATEST AutoCAD software for approximately 3 years)
6) http://www.circuitstoday.com/circuit-design-and-simulation-softwares
7) http://en.wikipedia.org/wiki/List_of_free_electronics_circuit_simulators
8) Android applications available on Google Play store like AutoCAD 360, Circuit Builder, Electric Circuit, Circuit Simulator, WeSpice Demo, Electric Circuit Calculator, Electrical Engineering

Course Curriculum Development Committee:

a. **Internal Faculty**
   i. Mrs. J. D. Waghmare
   ii. Mr.M.S.Narkhede
b. **External Faculty**
   i. Mrs.Meenakshi Shirsat

Academic Coordinator **Head of Department (Electrical Engineering)** **Principal Govt. Polytechnic, Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 213.1	3	3	3	3	0	1	1	1	1	1
EE16 213.2	3	3	3	3	0	1	1	1	1	1
EE16 213.3	3	3	3	3	0	1	1	1	1	1
EE16 213.4	3	3	3	3	0	1	1	1	1	1
Avg. of POs	3	3	3	3	0	1	1	1	1	1

CO Vs PSO matrix

CO	PSO1	PSO2	PSO3
EE16 213.1	2	3	1
EE16 213.2	2	3	1
EE16 213.3	2	3	1
EE16 213.4	2	3	1
Avg. Of PSOs	2	3	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE16305**				Course Title: **Electrical Energy Conservation & Audit** #					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
04		**02**	**06**	**70**	**30**	**--**	**50**		**150**

(*) indicates assessment by internal examiner

Rationale:

For implementing and monitoring effectiveness of the energy conservation methods and proper use of electrical energy, its audit is must. To maintain the growth of development, electricity generation will be required to be increased by proper mix of conventional and non-conventional sources of energy. But at the same time its conservation and audit should be done to increase the efficiency of electrical power system. Hence electrical engineers must have knowledge of various methods of energy conservation and concept of energy audit and its implementation.

Course Outcomes: Students will be able to-

EE 16 305.01	Identify the relationship between energy consumption and its impact on environment
EE 16 305.02	Describe energy conservation principle, its management concept and objectives
EE 16 305.03	Assess the energy saving & conservation in different electric sector
EE 16 305.04	Perform energy audits and decides simple payback period
EE 16 305.05	Employ devices and equipment used for energy auditing and its conservation

Course Content Details:

Unit No.	**Topics/Subtopics**
1	**Energy and Environment:** 1.1 Environment and social concerns related to energy utilization. 1.2 The green house effect. 1.3 Global Warming and its effect. 1.4 Pollution, Acid Rains. 1.5 Global Energy and environment Management.

2	**Elements of Energy Conservation and Management** 2.1 Present energy scenario, State and national level Sector wise Energy consumption, demand supply gap 2.2 Scope for energy conservation and its benefits 2.3 Energy conservation Principle: Maximum energy efficiency, Maximum cost effectiveness 2.4 Energy Conservation Act-Main features, Standards and labelling, designated consumers 2.5 Energy Conservation Building Codes (ECBC): Brief introduction of the salient features of the act 2.6 Energy management concept and objectives: Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting 2.7 Energy management programmes 2.8 Demand side Management, Aggregate Technical and Commercial loss
3	**Energy Conservation In Industries** 3.1Energy saving opportunities in electric motors : selection, overrating/ oversizing, efficiency vs output power curve, starting method 3.2Benefits of Power factor improvement and its techniques-Shunt capacitor, Synchronous Condenser etc., Block diagram of APFC panels (manual and automatic)Simple numerical on improvement of power factor by using shunt capacitor 3.3 Effects of harmonics on – Motors, and remedies leading to energy conservation 3.4 Energy conservation by VSD, Energy efficient motors, retrofitting of old motors 3.5 Energy conservation in electric furnaces, ovens and boilers., 3.6 lighting techniques – Use of Daylight , concept of output lumen per watt consumption of light source, use of modern lamp and luminaries (Ex. LED) over conventional lighting, dimming, voltage regulators 3.7 Methods and techniques of energy conservation: Ventilation and air conditioners, Area Sealing, Insulating the Heating / cooling fluid pipes , automatic door closing- Air curtain, Thermostat / Control 3.8 Identification of losses and its minimisation in the power distribution system: From point of supply to utilisation point- transformers, cables , wires, Hotspot at electric contacts
4	**Energy Conservation In Commercial and residential premises** 4.1 Requirement of electrical energy for a specific purpose in a school, college, shops, malls, banks, offices, house /flat, 4.2 Use of alternative energy source in place of electrical energy 4.3 Utility services in residential complex, building, civic bodies 4.4 Use of standard and labelling or Energy star marked electrical consumer goods or products 4.5 Adoption of energy conservation methods listed in 3.6, 3.7,3.8

5	**Energy Audit:** 5.1 Energy audit and its benefits 5.2 Energy flow diagram 5.3 Types of energy audits : Preliminary audit , Detailed audit 5.4 Methodology of Preliminary audit : ABC or Pareto Analysis, questionnaire form, data collection form, submission of preliminary audit report 5.5 Methodology of Detailed audit: i] Phase- I:pre audit,ii] phase-II: Audit process at site-Walk through audit and Device performance audit, iii]Phase- III post audit analysis and decision making 5.6 Energy audit report 5.7 Numerical on calculation of simple payback period for installing energy conservation equipment/devices
6	**Measurement and energy conservation Devices :** 6.1. Measurements of parameters in energy audit process 6.2List and brief description of various electrical non electrical measuring instruments are during audit process, such as –smart meters(V,I,W,KVA, KVAR, PF) data loggers , remote sensing and measurements devices, Power Analyser, thermometer-contact, infrared, leak detector, tachometer and lux meter etc 6.3. List and brief description of Equipment/devices used for energy conservation Example, such as – photo sensors, day light controller, occupancy sensors, temperature controllers, thermostats, humidity controllers, pressure controllers, timers, harmonic filters, voltage stabilizers, motor starters, PLC 6.4 Introduction to: Energy Management System, Internet of things and Mobile Application used for energy conservation

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Energy and Environment	02	02	04	-	**06**
2	Elements of Energy Conservation and Management	08	02	06	04	**12**
3	Energy Conservation In Industries	22	04	08	06	**18**
4	Energy Conservation In Commercial and residential premises	10	02	06	04	**12**
5	Energy Audit:	12	02	06	04	**12**
6	Measurement and energy conservation Devices :	10	02	04	04	**10**
	Total	**64**	**14**	**34**	**22**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of*

marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical:

Sr.No	Unit	Experiment/Assignment	Approx Hours
1	1,2	Prepare a report on Internet survey of State , National and International Agencies related to environment, energy conservation	**06**
2	2	Prepare report on Internet survey of energy conservation programmes of States , India and other countries	**04**
3	3,4, 5	Case study : Preliminary Audit of Any one of the following a]School/college b]Commercial premises c] Small scale industry/Heavy engineering workshop d] Utility services of civic body/large residential	**12**
4	6	Study of devices/equipment used for measurement and energy conservation during audit process	**06**
5	6	Literature survey of Energy Management System, IOT and Mobile Apps.	**04**

Reference Books:

Sr. No.	Book Title	Author	Publication
1	General aspects of Energy Management and Audit, 3rd edition	Bureau of Energy Efficiency	Bureau of Energy Efficiency
2	Energy Conservation and Audit	S.C.Tripathi	Tata Mcgraw Hill, New Delhi.
3	Power Factor Correction	Siemens	New Age Publishers
4	Energy Conservation	D. Yogi Goswami and Frank Kreith	CRC Press
5	Energy Audit and Management, Volume-I& II		IECC Press
7	Energy Conservation Act 2001 https://powermin.nic.in/sites/default/files/uploads/ec	Ministry of Law and Justice	GOI

	act2001.pdf		
8	Industrial Instrumentation, Volume 1	K Krishnaswamy	New age Intl.
9	Electrical measurements and measuring Instruments	R. K. Rajput	S. Chand

Course Curriculum Development Committee:

a. **Internal Faculty**

i. I. N Khuspe

ii. Mr. M. S. Narkhede

b. **External Faculty**

i. Dr.. Dilip Lulekar

Academic Coordinator **Head of Department (Electrical Engineering)** **Principal Govt. Polytechnic, Mumbai**

Unit and CO mapping:

Unit No.	Topic Title	Course Outcomes
1	Energy and the Environment	CO1,CO2
2	Elements of Energy Conservation and Management	CO1,CO2
3	Energy Conservation In Industries	CO2,CO3
4	Energy Conservation In Commercial and residential premises	CO2,CO3
5	Energy Audit	CO4,CO5
6	Measurement and energy conservation Devices	CO4,CO5

CO VsPO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 305.01	3	3	-	2	3	3	3	3	3	3
EE 16 305.02	3	3	3	2	3	3	3	3	3	3
EE 16 305.03	3	3	3	3	3	3	3	3	3	3
EE 16 305.04	3	3	3	3	2	3	3	3	3	3
EE 16 305.05	3	3	3	3	3	3	3	3	3	3
Av. Of POs	3	3	2.4	2.6	2.8	3	3	3	3	3

CO VsPO matrix:

CO	PSO1	PSO2	PSO3
EE 16 305.01	2	3	3
EE 16 305.02	3	3	3
EE 16 305.03	3	3	3
EE 16 305.04	3	3	3
EE 16 305.05	2	3	3
Av. Of PSOs	2.6	3	3

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 306**				Course Title: **Switchgear and Protection**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**06**	**70 (3 Hrs.)**	**30**	**50*(Ext)**	-	**-**	**150**

Rationale:

In generation, transmission and utilization of electrical energy switchgear and protection plays an important role for delivering uninterrupted power supply to the consumers. It is also necessary at various levels to protect the power system from damage. The electrical engineer must know switchgear and protection systems. It will help while working as a supervisor in substations, manufacturing industries & public service utilities.

Course Outcomes:

Student should be able to

EE 16 306.1	Identify the effects of abnormalities in the operation of power system
EE 16 306.2	Analyze the working principle and operation of current interrupting devices.
EE 16 306.3	Analyze the working principle and operation of protective relays .
EE 16 306.4	Identify the various components of switchgear and protection systems.
EE 16 306.5	Recognize the faults in the power system and remedies.
EE 16 306.6	Name the specifications and select the suitable switchgears in the protection of power system.

Unit No	Topics / Sub-topics
1	**Basic Concepts:** 1.1 Necessity and functions of protective system. 1.2 Substation equipment, functions and layout. 1.3 Faults and abnormal conditions. 1.4 Types of faults and their causes. 1.5 Short circuit calculations- Symmetrical faults only (Numerical problems). 1.6 Use of current limiting reactors & their arrangements.
2	**Circuit Interrupting Devices:** 2.1 Fuses –Terms and definitions, types, construction and Working characteristics, selection and applications (Rewirable, D-type, Cartridge, HRC and Drop-out Fuses) 2.2 Isolators- vertical break, horizontal break &pantograph type. 2.3 Arc formation process, methods of arc extinction, related terms. 2.4 Circuit breakers- Concept, Classification, Working principle, Construction, Specification and Applications of – Miniature circuit breakers (M C B) , Moulded case circuit breakers (M C C B) , Earth leakage circuit breaker (E L C B or R L C B),

	Sulphur Hexa Fluoride circuit breaker (SF6), Vacuum circuit breaker. Air Break& Air blast circuit breakers (ACB), Comparison of fuse & MCCB. 2.5 Selection of MCCB for motor. 2.6 Selection and rating of fuses & circuit breakers
3	**Protective Relaying:** 3.1 Functions, requirements and related terms. 3.2 Basic relay circuit. 3.3 Protective zones. 3.4 Primary and backup protection. 3.5 Desirable qualities of protective relaying. 3.6 Relay time and Fault clearing time. 3.7 PSM ,TSM ,Relay setting (Simple Numerical Problems) 3.8 Thermal Relay 3.9 Over current relay-Time current characteristics. 3.10 Introduction to Static relay 3.11 Static over current relays. 3.12 Static Distance relays 3.13 Microprocessor based over current relays. 3.14 Microprocessor based Distance relays 3.15 Microprocessor based Differential relays 3.16 Microprocessor based Directional relays 3.17 Microprocessor based Impedance relays **3.18** Introduction to Numerical relay
4	**Earthing:** 4.1 Introduction & importance. 4.2 Difference between neutral earthing and machine earthing 4.2 Types of earthing 4.3 Substation earthing
5	**Protection of Alternator:** 5.1 Abnormalities & Faults. 5.2 Differential protection (Simple Numerical Problems). 5.3 Over current, earth fault, inter turn fault, negative phase sequence, over heating protection. 5.4 Reverse power protection.
6	**Protection of Transformer:** 6.1 Abnormalities & faults. 6.2 Differential protection (Simple Numerical Problems). 6.3 Over current, earth fault, inter turn, restricted earth fault, over heating protection. 6.4 Buchholtz relay.
7	**Protection of Induction motor:** 7.1 Abnormal operating conditions and causes of failures. 7.2 Phase fault , Ground fault , Negative phase sequence protection , Single Phase preventer

8	**Protection of Bus bar and Transmission line:** 7.1 Abnormalities & faults. 7.2 Bus bar protection. 7.3 Transmission line protection- over current, distance protection. 7.4 Three Stepped distance protection. 7.5 Carrier Current protection.
9	**Over Voltage Protection:** 8.1 Causes of over voltages. 8.2 Lighting phenomenon & over voltage due to lightning. 8.3 Protection of transmission line & substation from direct stroke. 8.4 Types, Construction & principle of operation of lightning arresters & surge absorbers. 8.5 Protection against traveling waves. 8.6 Insulation co-ordination.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basic Concepts	04	2	4	0	**06**
2	Circuit Interrupting Devices	08	2	6	6	**14**
3	Protective Relaying	08	2	6	6	**14**
4	Neutral Earthing	04	2	2	0	**04**
5	Protection of Alternator	06	2	3	3	**08**
6	Protection of Transformer	06	2	3	3	**08**
7	Protection of Induction Motor	04	2	2	0	**04**
8	Protection of Bus bar and Transmission line	04	2	0	4	**06**
9	Over Voltage Protection	04	2	4	0	**06**
	Total	**48**	**18**	**30**	**22**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of experiments/Assignments:

Any ten (10) of the following

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	**2**	To identify the components of different types of low voltage and medium voltage circuit breakers with their specifications.(through visits , video or model). I) Miniature circuit breaker (M C B) II) Moulded case circuit breaker (M C C B)	**04**

		III) Earth Leakage circuit breaker (E L C B)	
2	2	To identify the components of different types of high voltage circuit breakers with their specifications.(through visits , video or model). I) Sulpher - Hexa fluoride circuit breaker (S F 6) II) Vacuum circuit breaker.	04
3	**2**	To Plot the characteristics of rewirable fuse.	**02**
4	**3**	To plot performance characteristics of over current relay.	**02**
5	**3**	To plot performance characteristics of IDMT relay.	**02**
6	**3**	To plot performance characteristics of Differential relay.	**02**
7	**3**	To plot performance characteristics of Impedance relay.	**02**
8	**5**	Simulation of alternator protection.	**04**
9	**6**	Simulation of transformer protection.	**04**
10	**7**	Simulation of Induction Motor protection.	**04**
11	**8**	Simulation of transmission line protection.	**04**
12	**9**	To identify the components of different types of lightning arresters with their specifications. (through visits , video or model).	**04**
13	**4**	To identify the components of different types of earthing with their specifications. (through visits , video or model).	**04**
14	**2**	To identify the components of different types of isolators with their specifications. (through visits , video or model).	**04**

Visit : Visit to a nearby substation and study all the circuit breakers, relays, isolators, lightening arrestors, etc and its protection scheme.

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Switchgear and Protection	Sunil S. Rao	Khanna Publishers, New Delhi.
2	Fundamentals of Power System Protection	Y. G. Paithankar and S. R. Bhide	Prentice-Hall India, New Delhi
3	Power System protection and Switch gear	Badri Ram	Tata McGraw Hill Education Private Ltd., New Delhi.
4	Switchgear and Protection	J. B. Gupta	S. K. Kataria and Sons, New Delhi.

Programme: **EE**									
Course Code: **EE16308**				Course Title: **Project & Seminar I**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	**-**	**4**	**4**	**-**	**-**		**50***	**-**	**50**

Rationale:
A Diploma holder in Electrical Engineering needs to supervise, operate and maintain electrical systems, in industries and fields. Project introduces the students to professional engineering practice by providing them with an opportunity to work on an engineering problem. It is also important to convey the ideas and to have effective communication with the people. In "Project & seminar I" student will present the seminar preferably on the selected project topic.

Course Outcomes: Student should be able to:

EE16308.1	Identify and use verity of academic resources.
EE16308.2	Carry out literature survey from various sources available.
EE16308.3	Organize the information for presentation.
EE16308.4	Develop audience-centered presentation.
EE16308.5	Ask meaningful questions.
EE16308.6	Prepare appropriately to participate effectively in class discussion.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Methodology:** • This course will be spread over two semesters i.e. fifth and sixth semester. • Course registration will be at the beginning of the fifth semester. • Students will form a batch of four to five students. • Students will o Identify the project and get it approved from the guide. o Carry out Literature survey o Plan and design the project o Identify the of required components
2	**Seminar:** • Student should present the seminar in fifth semester preferably on the selected project topic. • Every student will prepare and deliver the seminar. • Use of audio visual and / or power point presentation is desirable. • Presentation will be for @ 15 minutes including 5 minutes of question and answer.

3	**Submission of Seminar Document:** • The student shall get the seminar draft approved from Guide and complete final document before presenting seminar • Each student shall prepare two hard copies of final seminar document and retain one copy with student and submit one hard copy along with soft copy for department. • The structure of the seminar document shall be as per the following format: Certificate / Acknowledgement / Index / Introduction / Detailed content / Conclusion / References. • The seminar report shall be of minimum 10 pages and Max. 20 pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2 cm, bottom margin 2 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified. It should be certified by seminar Guide and Head of department.
4	**Suggestive list of topics for selection of project .** • Industry supported project • Energy Conservation and Audit. • Renewable energy. • Maintenance based project. • Smart Metering, Electricity Theft Reduction • Power Quality • Automation • Illumination Engineering • Green building Codes • Hybrid Vehicles • Variable Voltage Variable frequency drives • Traction new trends • BLDC motors • Smart Grid Applications • Simulation • Traffic light control system • Any other topics related to Electrical Engineering

Course Curriculum Development Committee:

a. **Internal Faculty**

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b. **External Faculty**

i. Mrs. Barnali S Motling (HOD, KJ Somaiya, Mumbai)

Academic Coordinator **Head of Department Electrical Engg.** **Principal Govt. polytechnic Mumbai**

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16308.1	--	2	--	--	2	--	--	3	3	2
EE16308.2	--	2	--	--	2	--	3	3	3	2
EE16308.3	--	2	--	--	--	--	2	3	3	2
EE16308.4	--	3	2	2	2	2	--	3	3	2
EE16308.5	1	3	--	--	--	--	--	--	3	2
EE16308.6	1	3	--	--	--	--	--	--	3	2

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16308.1	--	--	3
EE16308.2	--	--	3
EE16308.3	--	--	3
EE16308.4	--	--	3
EE16308.5	--	--	2
EE16308.6	--	--	2

Programme Code : **EE**									
Course Code: **EE16 401**				Course Title: **Power Electronics and Drives**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**-**	**2**	**6**	**70**	**30**	**50***		**-**	**150**

Rationale:

Power Electronics is ushering in a new kind of industrial resolution because of its important role in energy conservation, renewable energy systems, bulk utility energy storage, electric and hybrid vehicles in addition to its traditional roles in industrial automation and high energy efficiency systems. Electrical engineer should be competent enough to adjust with the new technology which has come due to advancements in Power Electronics. The intention of this course is to introduce important power electronic semiconductor switches and their applications as for the power conversion and control.

Course Outcomes: Student should be able to:

EE16401.1	Select appropriate power semiconductor device for a particular applications.
EE16401.2	Compare various power converters and their applications
EE16401.3	Select appropriate type of drive for a particular application
EE16401.4	Assemble and test simple power electronic circuit
EE16401.5	Trace the fault in the simple circuit

Course Content Details:

No derivation and No numerical for all Topics

Unit No	Topics / Sub-topics
1	**Power Semiconductor devices:** 1.1 Introduction to Thyristor family and other power devices. 1.2 SCR: Construction, symbol, working & V-I characteristics 1.3 Definitions: Holding current, latching current, break over voltage. 1.4 Construction, symbol, V-I characteristics and application of Triac, Diac, MOSFET and IGBT 1.5 Phase control using TRIAC Light dimmer Fan regulator Temperature Control using SCR or triac
2	**SCR turn on, turn off methods and protection circuits:** 2.1 SCR turn on methods : Voltage Triggering, Gate Triggering, dv/dt Triggering and Light Triggering, Temperature triggering. 2.2 Gate triggering circuits for SCR - Circuit diagram, working principle, waveforms of • Resistor triggering • R-C triggering • UJT triggering.

	2.3 Thyristor Turn off methods. a) Natural Commutation b) Forced Commutation : • Class A- Self commutation by resonating load • Class B- Self commutation by LC circuit • Class C- Complementary commutation • Class D – Auxiliary commutation • Class E – external pulse commutation di /dt protection, dv/dt protection
3	**Controlled Rectifier** 3.1 Difference between uncontrolled rectification and controlled rectification. 3.2 Single Phase Fully Controlled Half Wave Converter - With Resistive Load ,With RL Load and Freewheeling Diode. 3.3 Single Phase Fully Controlled Full Wave Converter - With Resistive Load & With RL Load. 3.4 Single Phase Fully Controlled Bridge Converter - With Resistive Load & With RL Load 3.5 Three Phase Fully Controlled Bridge Converter- With RL Load. 3.6 Comparison of 3 phase and 1 Phase Converters.
4	**Inverters** 4.1 Introduction. Classification of inverters according to nature of input source, method of commutation, connection of thyristor & commutating component. 4.2 Working principle & operation of • Basic and modified Series inverter , • Basic Parallel inverter 4.3 Circuit diagram , working ,waveforms of • Single phase half bridge inverter • Single phase full bridge inverter 4.4 Voltage control in single phase inverters (PWM Inverters):Different Techniques
5	**Chopper** 5.1 Chopper Principle 5.2 Control Techniques: • Constant Frequency System • Variable Frequency System 5.3 Step Up Chopper And Step down chopper 5.4 Circuit diagram and working of Class A, Class B, Class C, Class D and Class E choppers 5.5 SCR Vs MOSFET as the switching device used in chopper
6	**Drives and other application of power electronics :** 6.1 Concept of electric drives. 6.2 Adjustable speed drive VS servo drives 6.3 DC drives: Speed control of DC series motor with single phase half and full controlled converter. 6.4 Chopper based DC drive for separately excited DC motor. 6.5 Introduction to brushless DC motor. 6.6 Three phase half wave brushless DC motor. 6.7 Block diagram of DC brushless drive. 6.8 AC Drives - Speed control of three phase Induction Motor with Variable frequency • Voltage source inverter fed induction motor drive .

	• Pulse width modulated inverter fed induction motor drive **6.9 Other applications** Circuit diagram, operation of : • Static circuit breaker(DC and AC) • Induction heating control • Dielectric heating control

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Power Semiconductor devices	10	04	04	02	10
2	SCR turn on and turn off methods and protection circuits	10	04	04	02	10
3	Controlled Rectifier	10	04	06	02	12
4	Inverters	10	04	06	02	12
5	Chopper	10	04	06	02	12
6	Drives and other applications of power electronics	14	04	06	04	14
	Total	**64**	**24**	**32**	**14**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes:*This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of experiments / Assignments :

Sr. No.	Unit	Experiment / Assignment (Any 08)	Approx. Hours
1	1	Construct circuit & verify the V-I characteristic of SCR.	4
2	1	Construct circuit & verify the V-I characteristic of TRIAC.	4
3	1	Construct circuit & verify the V-I characteristics of power MOSFET.	4
4	1	Construct circuit & verify the V-I characteristics of power IGBT	4
5	1	Construct the circuit of light dimmer/ fan regulator	
6	1	Observe temperature control using thyristor	4
7	2	Construct circuit & observe firing angle (α) control of R , RC or UJT triggering	4
8	3	Observe the output of single phase fully controlled bridge rectifier using R load and RL load	4
9	4	Observe the output of single phase series or parallel inverter	4
10	4	Observe the output of half Bridge Inverter	4
11	6	Observe the output of step down chopper	4
12	6	Observe the output of step up chopper	4
13	7	Control of speed of Induction motor using v/f method	4
		Total	**32**

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Power Electronics	M. D. Singh & K.B. Khanchandani	McGraw-Hill Publishing
2	Power Electronics	Muhammad H. Rashid	Prentice Hall Of India Private Ltd.
3	Power Electronics	P S Bimbhra	Khanna Publishers.
4	Power electronics devices circuits and industrial applications	V.R. Moorthi	OXFORD
5	Electrical drives concepts and applications	Vedam Subramanian	McGraw-Hill Publishing

Course Curriculum Development Committee:

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b. External Faculty

i. Mr Rohan homkar K.J. Somaiya polytechnic Mumbai.

Academic Coordinator **Head of Department Electrical Engg.** **Principal Govt. polytechnic Mumbai**

Unit and CO mapping:

S.N.	Unit	CO
1	Power Semiconductor devices	CO1,C04,CO5
2	SCR turn on and turn off methods and protection circuits	CO1,C04,CO5
3	Controlled Rectifier	CO2,C04,C05
4	Inverters	CO2,C04,C05
5	Chopper	CO2,C04,C05
6	Drives and other applications of power electronics	CO3,C04,C05

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16401.1	**2**	**3**	**3**	**2**	**2**	**-**	**1**	**2**	**1**	**3**
EE16401.2	**2**	**3**	**3**	**3**	**3**	**1**	**1**	**3**	**1**	**3**
EE16401.3	**2**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**1**	**3**
EE16401.4	**2**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**3**
EE16401.5	**2**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**3**
Avg. of POs	**2**	**3**	**3**	**3**	**2.4**	**0.6**	**0.6**	**1.8**	**1**	**3**

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16401.1	**3**	**2**	**3**
EE16401.2	**3**	**2**	**3**
EE16401.3	**3**	**2**	**3**
EE16401.4	**3**	**2**	**3**
EE16401.5	**3**	**2**	**3**
Avg. of PSOs	**3**	**2**	**3**

Unit Vs CO Matrix

Unit	EE16401.1	EE16401.2	EE16401.3	EE16401.4	EE16401.5
1. Power Semiconductor devices	3	1	1	3	3
2. SCR turn on and turn off methods and protection circuits	3	1	1	3	3
3. Controlled Rectifier	3	3	1	3	3
4. Inverters	3	3	1	2	2
5. Chopper	3	3	1	2	2
6. Drives and other applications of power electronics	3	2	3	2	2
Avg. of COs	3	2.1	1.3	2.5	2.5

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 403**				Course Title: **Principles of Control System**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**05**	**70 (3 Hrs.)**	**30**	**-**	**50*(Ext)**	**-**	**150**

Rationale:

In changing economy now, a day more and more stress is being given up in increasing the throughput in industries. The basic tool for achieving this is automation. Control system being a backbone of the automation plays a vital role in engineering education. To understand and discharge the duties of an electrical engineer he/she should have knowledge of Principles of control system.

Course Outcomes:

Student should be able to

EE16403.1	Know the difference between different types of control systems.
EE16403.2	Understand the working principle and operation of closed loop system.
EE16403.3	Analyze different types of control actions and choose a particular action .
EE16403.4	Understand the concept of stability of system.
EE16403.5	Understand the time response of control system.
EE16403.6	Understand the frequency response of control system.

Unit No	Topics / Sub-topics
1	**Basics of Control System:** 1.1 Definition of Control System 1.2 Classification – open loop and closed loop system 1.3 Manually controlled and automatically controlled closed loop system 1.4 Examples of closed loop system – Automatic tank level control system, A position control system, Rudder control of ship. 1.5 Feedback and Its effect on: overall gain, Stability, Sensitivity, External disturbance/ noise. 1.6 Types of Feedback Control Systems – (Only introduction) a) Linear and Non Linear b) Time invariant and Time variant c) Continuous data and Sampled data (Discrete) 1.7 Transfer function and it's properties 1.8 Derivation of Transfer function for linear RLC series circuit. 1.9 Block Diagrams: a) use b) elements c) Six Rules for reduction technique d) block diagram for feedback control system (closed loop system) and derivation of it's transfer function.

	1.10 Signal Flow Graph, step by step construction of signal flow graph for given set of algebraic equations. 1.11 Basic properties of Signal flow graphs. 1.12 Definitions for Signal flow graphs: Input mode (source), output mode (sink), path, Forward path, Loop, Path gain, Forward-path gain, Loop gain, non-touching loops. 1.13 Manipulation and algebra of Signal flow graph 1.14 Example of construction of Signal flow graph. 1.15 Explanation of Mason's gain formula **1.16** Force (Torque) – Voltage and Force (Torque) – Current analogy between Mechanical Translational, Rotational and Electrical systems
2	**Time response of Control system:** 2.1 Transient and Steady state response of first order control system 2.2 Typical test signals for Time response of Control system: step, ramp and parabolic. **2.3** Unit step response of control system (rise time, delay time, settling time , maximum overshoot, steady state error)
3	**Concept of Stability:** 3.1 Stability: Definition, types (absolute, relative) 3.2 Impulse responses corresponding to different locations of roots of characteristic equation. 3.3 Relation between the transient response and the characteristic equation roots. 3.4 Root location in S plane for determining stability. 3.5 Hurwitz criterion 3.6 Routh Hurwitz criterion (Simple Numericals) 3.7 Root Locus: Definition of Root Loci, Complementary Root Loci, Root Counters, Complete Rot Loci. **3.8** Root Loci concept
4	**Frequency Response Analysis:** 4.1 Introduction 4.2 Correlation between time and frequency response **4.3** Frequency response analysis of system using Bode plot for standard function.
5	**Control actions :** 5.1.On-Off, P, I, P+I, P+D,P+I+D, actions **5.2.**Comparative advantages and disadvantages of PI, PD and PID actions

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basics of Control System	18	16	4	4	24
2	Time response of Control system	07	06	2	2	10
3	Concept of Stability	12	18	2	0	20
4	Frequency Response Analysis	07	08	2	0	10
5	Control actions	04	02	04	0	06
	Total	48	50	14	06	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of experiments/Assignments:

Any ten (10) of the following preferably in Matlab /Scilab software

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	**1**	Obtain Pole, zero, gain values from a given transfer function	**02**
2	**1**	Obtain Transfer function model from pole, zero, gain values	**02**
3	**1**	Obtain Pole, zero plot of a transfer function	**02**
4	**2**	Determine Step response of 1st order system	**02**
5	**2**	Determine Impulse response of 1st order system	**02**
6	**2**	Determine Step response of 2nd order system	**02**
7	**2**	Determine Impulse response of 2nd order system	**02**
8	**2**	Determine a) Step response of Type '0' system **b)** Impulse response of Type '0' system	**02**
9	**2**	Determine a) Step response of Type '1' system b) Impulse response of Type '1' system	**02**
10	**2**	Determine a) Step response of Type '2' system b) Impulse response of Type '2' system	**02**
11	**3**	To determine a) Effect of PI controller on system performance b) Effect of PD controller on system performance	**02**
12	**3**	Determine Root Locus plot of a 2nd order system	**02**
13	**3**	Observe the a) Effect of addition of zeros to forward path of an open loop system. b) Effect of addition of zeros to forward path of a closed loop system.	**02**
14	**3**	Observe the a) Effect of addition of poles to forward path of an open loop system. b) Effect of addition of poles to forward path of a closed loop system	**02**

15	**4**	Determine Bode plot of a 2nd order system	**04**

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Automatic Control Systems	Benjamin C Kuo	Prentice-Hall Inc, New Jercy
2	Control Systems Engineering	I.J.Nagrath , M.Gopal	New Age International , New Delhi

Course Curriculum Development Committee:

a. **Internal Faculty**
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   ii. Mr.A.K.Dhulshette

b. **External Faculty**
   i. Mr. L.S.Patil (Government Polytechnic, Nashik)

Academic Coordinator **Head of Department (Electrical Engineering)** **Principal Govt. polytechnic Mumbai**

EE16403.1	Know the difference between different types of control systems.
EE16403.2	Understand the working principle and operation of closed loop system.
EE16403.3	Analyze different types of control actions and choose a particular action .
EE16403.4	Understand the concept of stability of system.
EE16403.5	Understand the time response of control system.
EE16403.6	Understand the frequency response of control system.

Unit and CO mapping:

S.N.	Unit	CO
1	Basics of Control System	EE16403.1
2	Time response of Control system	EE16403.2
3	Concept of Stability	EE16403.6
4	Frequency Response Analysis	EE16403.4
5	Control actions	EE16403.3

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16403.1	3	3	2	1	1	1	1	1	1	1
EE16403.2	3	3	2	1	1	1	3	1	1	1
EE16403.3	3	3	3	1	3	1	1	1	1	1
EE16403.4	3	3	3	1	3	1	1	1	1	1
EE16403.5	3	3	3	1	1	1	1	1	1	1
EE16403.6	3	3	1	1	1	1	1	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16403.1	3	1	1
EE16403.2	3	3	1
EE16403.3	3	2	1
EE16403.4	3	1	1
EE16403.5	3	1	1
EE16403.6	3	1	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 404**				Course Title: **Illumination Engineering**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**00**	**03**	**70 (3 Hrs.)**	**30**	**-**	**-**	**-**	**100**

Rationale:

This course is designed to teach students various concepts of Illumination Engineering. Students shall apply the basic illuminations laws. He/She should be able to apply the acquired knowledge in designing the schemes. With changing needs of the society students shall be able to fulfil the optimized solution considering the need of energy conservation. He/She should be able to take care the needs of various sectors of the society in illumination area.

Course Outcomes:

Student should be able to

EE16 404.1	Understand the meaning of terms used in illumination engineering
EE16 404.2	Realize the requirements of various types of consumers
EE16 404.3	Study requirements of illumination levels for various applications
EE16 404.4	Understand illumination schemes fundamentals.
EE16 404.5	Differentiate between various types of lamps

Unit No	Topics / Sub-topics
1	**Fundamentals of Illumination:** 1.1.Fundamentals of Illumination 1.2.Illumination terminology: Illumination, Light intensity, Lumen, Lux 1.3.Laws of Illumination (Simple numerical) 1.4.Concept of Photometry 1.5.Measurement of Illumination 1.6.Features of good Illumination scheme 1.7.Biological effect of artificial illumination , Light pollution
2	**Lamps & Lighting Accessories:** 2.1 Types of Lights a. Visible light b. Ultraviolet light c. Infrared light 2.2 Types of Lamps a. Incandescent lamp b. ARC lamps – ac &dc arc lamp c. Fluorescent lamp d. Mercury vapour lamp, HPMV lamp, Mercury iodide lamp e. Sodium vapour lamp f. Neon lamp, Neon Sign Tubes

	g. Halogen lamp h. CFL Lamps i. Metal halides lamp j. LED lamps k. Lasers k. Selection criterion for lamps 2.3 Construction, working principle advantages and disadvantages of all lamps 2.4 Comparison between incandescent & Florescent lamps 2.5 Lighting schemes: selection of lamp, illumination efficiency, glare & power consumption a. Direct & Indirect b. Semi direct & semi indirect c. General lighting scheme 2.6 Lighting calculation methods a. Watt/m2 method b. Lumens or light flux method c. Point to point method (simple numerical)
3	**Illumination Control & Control Circuits:** 3.1 Purpose of lighting control 3.2 Working principle and operation of: a) Dimmer i) Resistance type dimmer ii) Salt water dimmer b) Dimmer Transformer i) Autotransformer dimmer ii) Two winding transformer dimmer c) Electronic Dimmer i) Thyristor operated dimmer ii) Triac operated dimmer 3.3 Control of enhance lightning 3.4 Methods used for light control 3.5 Control circuits for lamps: single lamp controlled by single switch, two switches 3.6 Single lamp controlled by two-point method, three-point method & four-point method. 3.1 Polar curve: its meaning and applications for designing the lamps
4	**Illumination for Interior Applications:** 4.1 Standards for various situations in Interior Illumination 4.2 Methods for Designing illumination schemes 4.3 Design considerations for Interior location of Residential Commercial, Industrial premises 4.4 Design Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit 4.5 Numericals on above sub topics

5	**Illumination for Outdoor Applications:** 5.1. General and specific requirements for lighting schemes of a) Factory Lighting b) Street Lighting c) Flood Lighting d) Railway Platform Lighting e) Lighting for Advertisement / Hoardings f) Sports Lighting g) Simple numericals based on design of simple scheme
6	**Lighting for Special Applications** 6.1. Lighting schemes and general requirements for: a) Agricultural & Horticultural applications b) Health Care Centers and Hospitals c) Decorative lighting d) Stage lighting **e)** Aquariums and Shipyards

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Fundamentals of Illumination	06	06	00	00	06
2	Lamps & Lighting Accessories	08	04	06	04	14
3	Illumination Control & Control Circuits	10	0	02	08	10
4	Illumination for Interior Applications	10	04	02	10	16
5	Illumination for Outdoor Applications	10	04	02	10	16
6	Lighting for Special Applications	04	00	02	06	08
	Total	48	18	14	38	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Applied Illumination Engineering	Jaclk L Lindsey	The Fairmont Pres Inc.
2	Lighting Engineering and applied calculations	R.H.Simons & Robert Bean	New Age International , New Delhi
3	Handbook of Industrial Lighting	Butterworths, Styanley , Lyons	Butterworths
4	Lighting Control Technology and Applications	Robert S Simpson	Focal Press
5	Energy Management in illuminating systems	Kao Chen	CRC Press

Course Curriculum Development Committee:

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Unit & CO Mapping:

Sr. No.	Unit	CO
1	Fundamentals of Illumination	EE16 404.1, EE16 404.4
2	Lamps & Lighting Accessories	EE16 404.2, EE16 404.3
3	Illumination Control & Control Circuits	EE16 404.3
4	Illumination for Interior Applications	EE16 404.2, EE16 404.5
5	Illumination for Outdoor Applications	EE16 404.2, EE16 404.5
6	Lighting for Special Applications	EE16 404.3, EE16 404.5

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 404.1	2	3	2	3	1	1	1	1	1	1
EE16 404.2	2	3	1	3	3	1	3	1	1	1
EE16 404.3	2	3	3	2	2	2	1	1	1	1
EE16 404.4	1	2	1	3	2	2	2	1	1	1
EE16 404.5	1	3	3	2	2	2	2	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16 404.1	2	1	3
EE16 404.2	3	2	3
EE16 404.3	3	2	3
EE16 404.4	2	1	3
EE16 404.5	2	1	3

Programme Code: **EE**									
Course Code: **EE 16 405**	Course Title: **Power System Analysis**								
Compulsory / Optional: **Optional (Elective-I)**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**--**	**--**	**03**	**70**	**30**	**--**	**--**	**--**	**100**

Rationale:

This subject deals with the representation of the power system, analysis of its components and determines performance by analytical as well as graphical methods which will be useful in analysis of electrical power system. This subject provides the basic knowledge required to study power system operation & control, Power Quality & Deregulation System.
Representation of power system will be useful to know the actual components of power system, Circuit model of system along with their per unit values. Transmission line parameter is useful to study the effects of parameter on performance of power system. Generalized circuit constants method is very useful & simple tool for predicting the performance of power system wrt. its parameters. Power flow serves as guidance for analysis of power system analytically & Circle diagram is a graphical tool for putting across the concept of load flow & line compensation,

Course Outcomes:

EE16405.1	Develop per unit reactance diagram for given system using power system components
EE16405.2	Compute Transmission line parameters
EE16405.3	Determine performance of line by using Generalized circuit constant equations
EE16405.4	Compute real power & reactive power for sending end & receiving end by using complex power equations.
EE16405.5	Construct the circle diagram to know the performance of transmission line

Contents:

1 : Representation of Power System

- Basic Structure of Power System.
- Equivalent Circuit representation of the System components-Alternator, Transformer,
- Transmission line: Short, Medium & long
- Single line diagram.
- Impedance diagram.
- Reactance diagram.
- Per unit Calculations. (Numerical)
- Aspects of Power System analysis.
- Role of power system Engineer

2 : Transmission Line Parameter

2-1 Resistance

- Concept of transmission line resistance.
- Difference between A.C. resistance & D.C. resistance.
- Influence of skin effect and proximity effect on Line conductors.

- Effect of temperature on Transmission line resistance.(No derivation)
- Effect of resistance on line performance.

2.2 Inductance

- Concept of Transmission Line Inductance.
- Significance of inductance.
- Flux linkage of isolated current carrying conductor due to internal and external flux. (Derivation only)

- Inductance of single-phase line composed of solid conductors & bundled conductors. (No Numerical)
- Concept of self G.M.D. and mutual G.M.D. (Numerical)
- Inductance of single phase line composed of composite conductors. (No derivation) Numerical
- Inductance of three phase line (single circuit) composed of solid conductors with symmetrical and asymmetrical spacing.

2.3 Capacitance

- Concept of Line capacitance.
- Significance of capacitance.
- Potential difference between two points due to charged conductors (Gauss's Law.)
- Potential difference between two conductors in a group of charged conductors.
- Capacitance of single phase line composed of solid Conductors and duplex bundled
- conductors. (Numerical)
- Capacitance of three phase line (single circuit) with symmetrical spacing. (Numerical)
- Effect of earth field on transmission line capacitance.
- Capacitance of single phase line with solid conductors considering earth.

3 : Generalized Circuit

3.1

- Concept of generalized circuit constants.
- Generalized circuit constants of short, medium & long transmission line.(No derivation) Numerical
- Measurement of Generalized circuit constant

3.2

- Generalized circuit constants of two networks connected in series & connected in parallel. (Only derivation)
- Advantages of Generalized circuit representation.

4 : Power Flow

- Concept of Complex Power (S=V I*), Real Power and reactive Power.
- Derivation of complex power, real power, reactive power for sending end as well as receiving end of the transmission line using GCE(Numerical)
- Condition for maximum power (Numerical)

5 : Circle Diagram

- Concept of circle diagram.
- Receiving end circle diagram. (procedure and numerical)
- Determination of ratings of reactive power compensating equipments. (procedure and numerical)
- Sending end circle diagram. (procedure and numerical)
- Advantages of circle diagram.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Representation of Power System	06	02	02	04	08
2	Transmission Line Parameter (R+L+C)	16	04	10	12	26 (6 +12+8)
3	Generalized Circuit	12	02	08	08	18 (12+6)
4	Power Flow	06	02	02	04	08
5	Circle Diagram	08	00	04	06	10
	Total	**48**	**10**	**26**	**34**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified*

Reference Books:

1. Electrical Power System by Dr. S. L. Uppal and Prof. S. Rao, Publisher: Khanna Publisher, New Delhi.
2. Power system Analysis and Design by B.R. Gupta Publisher: Wheeler.
3. Modern Power system Analysis (Fourth Edition 2011) by I. J. Nagrath & D. P. Kothari Publisher: Tata McGraw Hill.
4. Power system Analysis by J. John J. Graninger & Wiliam D. Stevenson J. R Publisher: Tata McGraw Hill.
5. Electrical power systems by C. L. Wadhwa, Publisher: New Age International
6. Power System Analysis by T. K. Nagsarkar & M. S. Sukhija, Publisher: OXFORD University Press

Websites:

www.mahatransco.com
www.mhdcl.com

Course Curriculum Development Committee:

a. **Internal Faculty**
   i. Dr. P.N. Padghan
   ii. Dr. M.S. Narkhede

b. **External Faculty**

i. Mrs S. S. Kulkarni (VPM Polytechnic, Thane)

Academic Coordinator **Head of Department (Electrical Engineering)** **Principal Govt. Polytechnic, Mumbai**

CO VS PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16405.1	3	3	2	2	1	1	1	--	1	3
EE16405.2	--	2	3	3	--	1	1	1	1	2
EE16405.3	--	2	3	3	1	2	2	2	1	3
EE16405.4	2	3	3	3	3	3	2	3	1	3
EE16405.5	2	3	3	3	3	3	2	3	1	3
Avg. of POs	1.4	2.6	2.8	2.8	1.6	2.0	1.6	1.8	1	2.8

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16405.1	1	3	2
EE16405.2	2	3	2
EE16405.3	2	3	3
EE16405.4	2	3	3
EE16405.5	2	3	3
Avg. of PSOs	1.8	3	2.6

Unit Vs CO Matrix

Unit	EE16405.1	EE16405.2	EE16405.3	EE16405.4	EE16405.5
1	3	2	2	2	1
2	2	3	2	2	2
3	1	2	3	2	2
4	2	2	2	3	2
5	2	2	2	2	3
Avg. of COs	2.0	2.2	2.2	2.2	2.0

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 312**				Course Title: **Industrial Training - I**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
00	**00**	**04**	**04**	**-**	**-**	**-**	**50***	**50**	**100**

Rationale:

The diploma engineers are required to work in industry to manufacture and test Semi finished/Finished Products, and in substations etc for diagnose problems and technical resolutions. The students need to have industry and workshop exposure, where they can experience real life equipment, materials, instruments and various kinds of Process & related Equipments. This course has been designed for the students to have real life experiences to help them prepare for their career. The Electrical sector needs skilled and managerial personnel who have technical expertise as well as entrepreneurial qualities to manage the industry and substation.

Course Outcomes:

EE 16 312.1	Assign the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation.
EE 16 312.2	Furnish the opportunities for practical, hands-on learning from practitioners in the students' areas of specialization.
EE 16 312.3	Expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field.
EE 16 312.4	Enhance the employability skills of the students.
EE 16 312.5	Provide opportunities for students to be offered jobs in the organizations in which they undergo their Industrial Training.

DURATION OF INDUSTRIAL TRAINING:

Total no. of weeks: 4 weeks before the beginning of 5th semester after finishing of final exam of 4th semester (during summer vacation of 5th Semester).

Training Area: Students can be trained in

1. electrical machines production units,
2. Generating stations,
3. electrical substations ,
4. domestic rewiring
5. Electrical appliances maintenance shops/workshops,
6. Power system protection ,
7. Locomotives ,

8. Industry Automation,
9. Lifts / Elevators maintenance
10. Repairing of electrical measuring instruments
11. Renewable energy sources
12. Electrical contractor ,
13. Authorized Testing Laboratories workshop ,
14. Technical Consultant etc.

Role of Department:

1. Department have to send training request letter to various industries well in advance before commencement of training.
2. After getting sufficient number of seats from the industries, students will be placed in different industries for their 5th semester training (during summer vacation).
3. Students will have to fill up training form.
4. Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
5. All above activities have to be carried out in advance of previous semester as plan out of placement in consultation with students. The students would normally be placed as per their choices, in case of more demand for a particular industry/service centre, students would be allocated place based on their relative merit (based on third semester results)
6. During the training period, the head of the department will maintain a schedule for follow up of industrial training and according to it he/she will send the faculty members to various industries.
7. The faculty member in touch with industry will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
8. At the end of the training internal faculty member will assess the work done by student based on his presentation at the institute and training report.

Role of Industry:

1. Industry will give effective training to the students for improving their practical skills
2. Industry is expected to assign group of the students under training to some middle management level person for supervision and guidance (Training-in-charge).
3. Training in-charge has to sign weekly diary (To certify the work done by students) with appropriate remarks.
4. Industry may allot project to individual or group of students under training and students has to prepare report on the same project.
5. Training in-charge are requested to guide students for preparing their project report.
6. Industry is expected to maintain attendance for the student under training and report any irregularity of the students to their parent college.
7. Industry is also expected to issue a certificate of attending training on their letter head with comments if any for student's record and motivation.

Guidelines for the Students

1. Students would interact with the identified faculty of the department to suggest his choices for suitable industry/service centre

2. Students have to fill the forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.
3. Student would carry with him/her the Identity card issued by institute during training period
4. He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry. Student is expected to follow these rules, regulations, procedures etc obediently.
5. During the training period students has to keep record of all the useful information in Log book and maintain the weekly diary (attached here with form-1).
6. Prepare final report about the whole training for submitting to the department at the time of final presentation i.e. seminar.

Seminar

- Every student will prepare the Industrial training report and deliver the seminar.
- Seminar will be on the Industrial training completed by the student in the industry .
- Use of audio visual and / or power point presentation is desirable.
- Presentation will be for @ 15 minutes including 5 minutes of question and answer.
- Seminar should be presented during fifth semester.

FORM-1

GOVERNMENT POLYTECHNIC,MUMBAI
ELECTRICAL ENGINEERING DEPARTMENT

TRAINEES WEEKLY REPORT

Trainee Name:-

Name of Organization:-

Enrollment No:-

Dept. Sec:-

Week commencing from date _____ to date _____

Day & Date	Abstract of Work done (Details of work with details of Electrical)	Remarks from training supervisor: Excellent / very good / good/ average / below average /poor	Sign of Training Supervisor

Course Curriculum Development Committee:

a. **Internal Faculty**
   i. Mrs. J. D. Waghmare
   ii. Dr. P. N. Padghan
   iii. Dr. M.S.Narkhede

b. **External Faculty**
   i. Mr. H.B. Chaudhari VJTI, Matunga, Mumbai

Academic Coordinator **Head of Department (Electrical Engineering)** **Principal Govt. polytechnic Mumbai**

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 312.1	3	3	3	3	3	3	3	3	3	3
EE 16 312.2	3	3	3	3	3	3	3	3	3	3
EE 16 312.3	3	3	3	3	3	3	3	3	3	3
EE 16 312.4	3	3	3	3	3	3	3	3	3	3
EE 16 312.5	3	3	3	3	3	3	3	3	3	3

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE 16 312.1	3	3	3
EE 16 312.2	3	3	3
EE 16 312.3	3	3	3
EE 16 312.4	3	3	3
EE 16 312.5	3	3	3

Undertaking Form

I hereby declare that during my Industrial Training at _____ , during the period from _____ to_____ , I will obey all the rules and regulations of the Industry . It will be my sole responsibility for my acts , deeds , any injury or accidents during this Industrial training.

Signature of Candidate

Name:-_____

Enroll No:-_____

Date: _____

Undertaking from Parents /Guardians

I the undersigned father/guardian of_____ am well aware that my ward studying in 3rd/2nd year Electrical Engg. is going for Industrial Training at _____ , during the period from _____ to_____ , I will obey all the rules and regulations of the Industry . It will be fully responsibility of my ward for his acts , deeds , any injury or accidents during this Industrial training.

Address with Mobile No

_____

_____

_____

Mobile No:-_____

Date:

Signature of Parent

Name of Parent

Industrial Training Report Format

1. Cover Page
2. Inner Pages
    a) Certificate with signature and seal by Industry/ Company/Factory
    b) Declaration by student
    c) Acknowledgement
3. Introduction about Industry/ Company/Factory
4. Training schedule
5. Table of Contents
6. List of Tables
7. List of Figures
8. Abbreviations and Nomenclature (If any)
9. Chapters
    1 Introduction to Project
    2 Tools & Technology Used
    3 Snapshots
    4 Work Done / Observations
    5 Specific Assignment / Project Handled
    4. Results and Discussions
    5. Conclusions and Future Scope
10. References
11. Data Sheet(If any)
12. Appendices (If any)

INSTRUCTIONS FOR TRAINING REPORT

1. A chapter may be further divided into several divisions and sub-divisions depending on type & volume of work.
2. The length of the training report may be about 20 to 30 pages.
3. The training report shall be computer typed (English- British, Font -Times Roman, Size-12 point) and printed on A4 size paper.
4. The training report shall be Hard Copy of Training Report (Spiral Binding) The training report shall be typed with 1.5 line spacing with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom. Every page in the report must be numbered. The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv..... The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5... All printed page numbers should be located at the bottom centre of the page.

5. **The table of contents** should list all headings and sub-headings.
6. **The list of tables** should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.
7. **The list of figures** should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.
8. The list of symbols, abbreviation & nomenclature should be typed with one and a half line spacing. Standard symbols, abbreviation etc should be used.
9. Subject matter must be typed on single side of the page.

All the pages must be numbered properly

INDUSTRIAL TRAINING REPORT

(Times New Roman, 24 pt. Bold)

TITLE OF THE PROJECT

(Times New Roman, 16 pt. Bold)

Submitted in partial fulfillment of the

Requirements for the award of

Diploma in Electrical Engineering

College LOGO

Submitted By (14 size)

Name: _____

Enrollment No._____

(Times New Roman, 14 pt. Bold)

SUBMITTED TO:

Department of Electrical Engineering (16 size)
GOVERNMENT POLYTECHNIC, MUMBAI

DECLARATION (16 Times New Roman)

I hereby declare that the Industrial Training Report entitled ("Title of the project") is an authentic record of my own work as requirements of Industrial Training during the period from _____ to_____ for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai under the guidance of (Name of Project Guide).

(12 size)

(Signature of student)
(Name of Student)
(Enrollment No.)

Date: _____

CERTIFICATE

(16 Times New Roman, bold)

This is to certify that Mr. / Ms._____ has partially completed / completed Industrial Training during the period from _____ to_____ in our Organization / Industry as a Partial Fulfillment of for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai . He / She was trained in the field of _____ .

Signature & Seal of Training Manager

Note: This certificate must be typed on the company letter head.

ACKNOWLEDGEMENT

(16 Times New Roman, bold)