

Government Polytechnic, Mumbai

Department of Electrical Engineering

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

Semester-III (Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government) 49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

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Progr	amme: Electric	al Engineering		Third	Semes	ster					W	ith effec	et from J	<u>une 2017</u>		
Teach	ing & Examina	ntion Scheme for the Students	admitte	d in Second Yo	ear in	2017-1	8									
Semes	ster : III															
Sr.	Course Code		C TH		Awards	Compulsory/	s	Te: cheme(aching (Hrs./V	g Week)		Exai	nination	Scheme	me (Marks)	
No.	Course Coue	Course Hue	of Class	Optional -	L	TU	Р	Total Credits	ТН	TS	PR	OR	TW	Total		
1	EE 16 208	Electrical Materials & Wiring	0	С	2	0	2	4	0	0	0	75*	25	100		
2	EE 16 209	Electrical Measurement	0	С	3	0	4	7	70	30	50*	0	0	150		
3	EE 16 210	Electrical Power Generation#	0	С	4	0	0	4	70#	30#	0	0	0	100#		
4	ME 16 211	Elements of Mechanical Engineering	0	С	2	0	2	4	0	0	0	50*	0	50		
5	HU 16 104	Environmental Studies	0	С	0	2	0	2	0	0	0	25*	25	50		
6	EE 16 211	Electrical Circuit & Network	0	С	3	2	2	7	70	30	50*	0	50	200		
7	EE 16 212	DC Machine & Transformer	0	С	3	2	2	7	70	30	50*	0	50	200		
					17	6	12		280	120	150	150	150			
	Total Credits						35		,	Total Ma	arks		850			

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.

Progra	amme Co	ode: EE										
Course	e Code:]	EE 16 20	8	Cours	se Title:	Electric	al Mater	ials and	Wiring	3		
Comp	ulsory / (Optional	: Compuls	ory								
Teach	ing Sche	me and (Credits	Duration of Examination			Examination Scheme					
ТН	TU	PR	Total	ТН	TS	PR	ТН	TS	PR	OR	TW	Total
02		02	04							75*	25	100
(*) in	dicates as	ssessmen	t by Extern	al exam	iners		•	·				

Rationale:

Basic knowledge of materials used in electrical engineering is essential for an electrical engineer. Also the knowledge of wiring accessories, wiring methods is vital for an electrical engineer. This subject is intended to develop skills of wiring and testing in the electrical wiring installations. This subject also gives insight of Electrical Engineering Materials.

Course Outcomes:

EE 16 208.1	List Physical, Mechanical and Electrical properties of electrical conducting materials
EE 16 208.2	List Thermal, Mechanical and Electrical properties of electrical insulating materials
EE 16 208.3	Classify insulating materials based on temperature withstanding ability
EE 16 208.4	Categorize magnetic materials
EE 16 208.5	Make up different types of wiring

Contents:

01 Classification of electrical materials.
1.1 Importance of Materials in Electrical Engineering
02 Conducting Materials (Physical, Mechanical and Electrical properties):
2.1 Current Carrying Conducting Materials(Copper, Aluminum, Bronze and Iron)
2.2 Non Current Carrying Conducting Materials(Cast iron, Cast Steel, etc)
03 Insulating Materials(Thermal, Mechanical and Electrical properties):
3.1 Classification on basis of state of materials as solid ,liquid gaseous insulating materials (
Introduction and applications)
3.2 Classification on the basis of temperature withstanding ability such as Y (O), A, E, B, F,H and C
type with list of insulating materials in each type.
3.3 Effect of Nano Technology on properties of materials
04 Magnetic Material (Introduction and Applications)
4.1 Classification of magnetic material as Paramagnetic, Diamagnetic and Ferromagnetic material
C.R.G.O. Silicon Steel
• H.R.G.O. Silicon Steel
Amorphous Metal
 05 Wiring
5.1 Classification of electrical installations

5.2 General requirements of electrical installation

1

5.3 Reading & interpretation of electrical engineering drawings & symbols related to installations
5.4 Types of Wires – PVC, CTS, TRS, Lead Sheathed, flexible, multicore, single strand, multi-
strand
06 Methods of Wiring and Different types of Wiring systems
6.1 Methods of Electrical Wiring systems w.r.t taking connection
6.2 Joint Box or Tee or Jointing system
6.3 Loop-in or Looping system
6.3.1 Advantages of loop-in method of wiring
6.3.2 Disadvantages of loop-in method of wiring
6.4 Different types of Electrical wiring systems
6.5 Cleat Wiring
6.5.1 Advantages of Cleat wiring
6.5.2 Disadvantages of Cleat wiring
6.6 Casing and Capping wiring
6.6.1 Advantages of Casing and Capping wiring
6.6.2 Disadvantages of Casing and Capping wiring
6.7 Batten wiring (CTS/ TRS)
6.7.1 Advantages of Batten wiring
6.7.2 Disadvantages of Batten wiring
6.8 Lead sheathed wiring
6.9 Conduit wiring
6.9.1 Surface conduit wiring
6.9.2 Concealed conduit wiring
6.10 Types of Conduit
6.10.1 Metallic conduit
6.10.2 Nonmetallic conduit
6.11 Advantages of Conduit wiring system
6.12 Disadvantages of Conduit wiring system
6.13 Comparison between different Wiring systems

Suggested specification table with Hours and Marks (Theory)

Unit		Teaching	Distribution of Theory Marks					
No	Topic Title	Hours	R Level	U Level	A Level	Total Marks		
1	Classification of electrical materials	2						
2	Conducting Materials (Physical, Mechanical and Electrical properties)	6						
3	Insulating Materials(Thermal, Mechanical and Electrical properties)	6						
4	Magnetic Material (Introduction and Applications)	6						
5	Wiring	4						
6	Methods of Wiring and Different types of Wiring systems	8						
	Total	32						

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.*

Sr,No.	Unit	Experiment/Assignment	Approx- Hours
1	5	Identify the different types of fuses with their applications.	2
2	5	Draw diagrams of different wiring accessories.	4
3	5	Identify samples of different types of wires.	2
4	6	Build wiring circuit for one lamp controlled by one switch	2
5	6	Build a sample staircase wiring	2
6	6	Build a sample godown wiring	2
7	6	Build a sample cleat wiring	2
8	6	Build a sample Casing Capping wiring	2
9	6	Build a sample batten wiring	2
10	6	Build a sample Conduit wiring	2
11	6	Trace and draw a electrical installation of a classroom	2
12	6	Trace and draw a electrical installation of a laboratory / workshop	2
13	2	Identify the current carrying conducting material in at least five electrical accessories / devices.	2
14	4	Identify the magnetic material in a given electrical motor, Electric choke/ballast.	2
15	3	Identify the name and class of insulation of insulating material in any five electrical accessories / equipment/ instrument/ device	2

List of Practical's: - Out of following 10 practicals are compulsory

Reference Books:

a) Books

Sr. No.	Book Title	Author	Publication
1	An introduction to Electrical	C.S.Indulkar	S.Chand, New Delhi
	Engineering Materials		
2	Electrical Wiring estimating and	S.L.Uppal	Dhanpat Rai and Sons
	costing		

b) Softwares/ Websites

1. http://www.electricaltechnology.org/2015/09/types-of-wiring-systems-electrical-wiring-methods.html

Course Curriculum Development Committee:

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

b. External Faculty

i. Dr.S.V.Bhangale (Lecturer, Government Polytechnic, Nashik)

Academic Coordinator

Head of Department Electrical Engineering Dept.

Principal Govt. Polytechnic Mumbai

CO Vs PO Matrix

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 208.1	1	2								
EE 16 208.2	1	2								
EE 16 208.3	1	2								
EE 16 208.4	1	2								
EE 16 208.5	3	2	3	1		1				

CO Vs PSO Matrix

СО	PSO1	PSO2	PSO3
EE 16 208.1			1
		1	
EE 16 208.2		1	1
EE 16 208.3		1	1
EE 16 208.4		1	1
EE 16 208.5	3		3

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Program	nme Co	de: EE							
Course	Course Code: EE 16 209 Course Title: Electrical Measurement								
Compu	lsory / C	Optional	Compu	lsory					
Teachi	ng Sche	me and	Credits			Examinati	on Scheme		
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3		4	7	70(3 Hrs)	30	50 *			150

Rationale:

This is the subject where the concepts, facts, principles and applications of electrical measurements are studied. These are necessary for experimentation in electrical engineering and also for achieving high degree of accuracy in experimentation. This course is necessary for applications in the field of measurements.

Course Outcomes:

EE 16 209.1	Define terminology used in electrical measuring instruments.
EE 16 209.2	Demonstrate various constructional parts of electrical measuring instruments with working principles.
EE 16 209.3	Measure electrical quantities with various instruments.
EE 16 209.4	Explain calibration procedure of electrical measuring instruments.
EE 16 209.5	Select suitable measuring instruments for particular application.

Unit No.	Topics/ Sub Topics:
1	Basic Concepts:
	1.1 Purpose of measurement & significance of measurement.
	1.2 Various effects of electricity employed in electrical measuring instruments.
	1.3 Characteristics of Instruments: <u>Static</u> - Accuracy, Precision, sensitivity, resolution,
	Static error, Repeatability, Drift, Dead zone. Dynamic- speed of response, Lag,
	Fidelity, Dynamic error.
	1.4 Types of static error- Gross, Systematic, Random.
	1.5 Classification of instruments based on –
	a) Electrical effects.
	b) Nature of operation.
	c) Limits of permissible errors.
	1.6 Different types of torque in Analog Instruments.
2	Measurement of Current and Voltage:
	2.1 Construction and principle of PMMC, MI & Electro-dynamometer type Instrument.
	Merits and demerits.
	2.2 Methods of production of torque.
	2.3 Extension of Range of Ammeter and Voltmeter. (Simple Numerical)
	2.4 Different methods of Extension of Range of Ammeter and Voltmeter.
	2.5 Errors and their compensation.
	2.6 Calibration of Ammeter and Voltmeter.
	2.7 Clamp on meter construction and working.
	2.8 Digital ammeters and voltmeters, application.

3	Instrument Transformers:
	3.1 Construction, theory and errors in CT and PT.
	3.2 Effect of secondary of CT open circuited.
	3.3 Use of C1 and P1 for extension of ranges.
	5.4 Specifying a C1 and P1 Polarity.
4	Measurement of Power:
	4.1 Concept of power in A.C. Circuit.
	4.2 Principle and Construction of dynamometer type wattmeter
	4.3 Errors and their compensation.
	4.4 Poly phase wattmeter.
	4.5 Measurements of power in 3 phase circuit for balanced and unbalanced load
	4.6 Effect of power factor variation on wattmeter readings in two wattmeter method.
	4.7 Measurement of reactive power in three phase balanced load by one wattmeter method
	4.8 Digital Wattmatar Principle Block Diagram advantages
	4.8 Digitar wattheter – I metple, block Diagram, advantages
5	Measurement of Electrical Energy:
	5.1 Concept of electrical energy.
	5.2 Constructional feature & principle of working of single phase and three-phase induction tupe energy mater
	5.3 Constructional feature & principle of working of single phase and three phase
	bidirectional (Import-Export type) energy meter
	5.4 Different types of errors and their compensation.
	5.5 Calibration of energy meter.
	5.6 Electronic energy meter.
	5.7 Tri vector meter- Construction, working and Applications.
(
0	6.1 Classification of Pasistance, Low Medium and High
	6.2 Methods of Measurements of Low, Medium and High Resistance (Potentiometer
	Wheatstone's bridge and Megger)
	6.3 Measurement of Earth resistance- Earth tester (Analog & Digital)
	6.4 Measurement of Transmission tower footing resistance.
	6.5 Digital Multimeter.
	6.6 L.C.R. Meter – Block diagram and working
	6.7 Testing of faults in cable.
7	Oscilloscope
	7.1 Block diagram study of CRO
	7.2 Lissajous pattern, use of these in phase & frequency measurements.
	7.3 Concept of Dual trace, dual beam, Sampling, storage, Digital read-out oscilloscope.
8	Other Meters:
	8.1 Single phase and three phase Power Factor Meter (only dynamometer type).
	8.2 Frequency meter (Weston and Ferro dynamic type).
	8.3 Digital Frequency Meter.

Unit		Teaching	Distribution of Theory Marks				
No	Topic Title	Hours	R Level	U Level	A Level	Total Marks	
1	Basic Concepts	04	04	02	00	06	
2	Measurement of Current and Voltage:	08	02	06	04	12	
3	Instrument Transformers	04	02	04	00	06	
4	Single phase transformer.	10	04	04	04	12	
5	Measurement of Electrical Energy:	06	06	04	00	10	
6	Measurement of Resistance, Inductance and	08	02	06	04	12	
7	Oscilloscope	04	04	02	00	06	
8	Other Meters	04	04	02	00	06	
		48	28	30	12	70	

Suggested specification table with Hours and Marks (Theory)

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

Sr	Unit	Evnorimont/Aggignmont	Annew
No.	No.	Experiment/Assignment	Hours
1	2	To study the constructional details of PMMC and MI instruments.	02
2	2	To measure high value of DC current by low range ammeter with shunt.	02
3	2	To measure high value of DC voltage by low range voltmeter with multiplier.	02
4	3	i) To measure high value of AC current by low range ammeter with CT.ii) To measure high value of AC voltage by low range voltmeter with PT.	02
5	4	To measure active and reactive power in three phase balanced load by one wattmeter method.	02
6	4	To measure active power in three phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.	02
7	5	To calibrate and use single phase energy meter.	02
8	6	To measure medium resistance by Wheatstone's bridge.	02
9	4	i) To measure insulation resistance by Megger.ii) To measure Earth resistance by earth tester. (Substation / Earth pit.)	02
10	6	To measure electrical quantities by digital multimeter and clamp on meter.	02

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11	8	i) To measure frequency of AC supply.	02
	•		• –
		ii) To measure power factor of single phase and three phase load.	
12	6	To measure circuit parameters by LCR meter	02
12	0	To measure circuit parameters by LCK meter.	02
13	7	To measure voltage and frequency of single phase a.c. voltage.	02

Reference Books:

Sr. No.	Name of Book	Author	Publisher
1	Electrical and Electronics	A. K. Sawhney	Dhanapat Rai and Co., New
	Measurements and		Delhi
	Instrumentation		
2	Electrical Measurements and	Golding and Viddis	A. H. Wheeler & Co. Ltd,
	Measuring Instruments		New Delhi
3	Methods of Electrical	C.T. Baldwin	Blakie Publications, London
	Measurements		

Course Curriculum Development Committee:

a. Internal Faculty

- i. Mr. A.K. Dhulshette
- ii. Dr. M.S. Narkhede

b. External Faculty

i. Dr. M.A. Ali (LEE, Govt. Polytechnic, Aurangabad)

Academic Coordinator

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

CO Vs PO Matrix

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 209.1	3	2	1	2	2	2	2	-	-	2
EE 16 209.2	3	3	3	3	3	2	2	-	-	3
EE 16 209.3	3	3	3	3	3	3	2	-	-	3
EE 16 209.4	3	3	3	3	2	2	2	-	-	3
EE 16 209.5	3	3	3	3	2	2	2	-	-	3
Avg. of POs	3	3	3	3	3	2	2	-	-	3

CO Vs PSO Matrix

СО	PSO1	PSO2	PSO3
EE 16 209.1	2	1	1
EE 16 209.2	3	3	3
EE 16 209.3	3	3	3
EE 16 209.4	3	2	2
EE 16 209.5	3	2	2
Avg. of PSOs	3	2	2

Programme Code: EE									
Course Code: EE 16 210 Course Title: Electrical Power Generation [#]									
Compulsory / Optional: Compulsory									
Teachi	Teaching Scheme and Credits Examination Scheme								
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
04			04	70 [#]	30#				100

(#) - indicates on line exam

Rationale:

This is the subject where the principles of electrical power generation systems are studied. Knowledge of different methods of generation of electricity and recent trends in the field is necessary for an electrical engineer. In this course, student will learn various method of generating power with function, location of equipment involved in power system operation. It also deals with economics of generation.

Course Outcomes:

The students will be able to

EE 16 210.1	Recall the principle of generation of electrical power and importance of grid system.
EE 16 210.2	Illustrate working, location of main equipment in different power plants
EE 16 210.3	Construct block diagram of different power plants.
EE 16 210.4	Compare different types of power plants.
EE 16 210.5	Interpret energy bills for different customers using various tariffs.

Contents:

1 : Introduction:

1.1 Need of energy.

- 1.2 Electrical energy system.
- 1.3 Voltage level in AC Network.
- 1.4 Primary Conventional and non-conventional energy resources and energy conversion processes.
- 1.5 Types of generating stations.
- 1.6 Terms related to power generation: Energy resources, fuel, Pollution, Thermal efficiency,
- Thermodynamics, combined cycle plant, Installed capacity, Fossil fuels.
- 1.7 Interconnected power system.
- 1.8 National Grid of India.

2 : Thermal Power Stations:

2.1 Introduction

- Installed capacity in Maharashtra state, India
- 2.2 Selection of site for thermal power stations.
- 2.3 General layout of thermal power station.
- 2.4 Thermodynamic cycle
 - Definition, diagram.
 - Typical values of steam at turbine inlet

- Efficiency of Rankine cycle.
- 2.5 Main equipment in thermal power plant:
 - 2.5.1 Coal storage and Handling plant
 - Function
 - Types of coal in order of heat value.
 - Equipment used in coal handling plant.
 - Location of coal storage and handling plant
 - 2.5.2 Ash storage and handling plant:
 - Function
 - Problems in Ash handling plant in India
 - Classification of modern ash handling system
 - Location of Ash storage and handling plant
 - 2.5.3 Steam Boilers:
 - Function
 - Requirement of Boiler
 - Types of Boiler: fire tube boiler, water tube boiler, Fluidized Bed Combustion boiler (FBCB).
 - Location of steam boiler
 - 2.5.4 Function, Types, Location of following equipment: superheater, Economiser, Air Preheater, Steam turbines, Condensers.
 - 2.5.5 Feed Water circuit
 - 2.5.6 Cooling water systems.
 - 2.5.7 Turbine Governing
- 2.6 Pollution control: problems of Dust collection from flue gases, types of pollution control, Electrostatic Precipitator
- 2.7 Advantages and disadvantages of thermal power plant.
- 2.8 List of Thermal power plant in India, Maharashtra.

3 : Hydro-electric Power Plants:

- 3.1 Introduction
 - Installed capacity in Maharashtra state, India
- 3.2 Classification of hydroelectric power plants.
- 3.3 Selection of site for hydroelectric power plants.
- 3.4 General layout of hydroelectric power plants.
- 3.5 Function and location of following component: Reservoir, Dam, Spill ways, Intake, Forebay, Penstock, Surge tank, Turbine, Power house, Draft tube.
- 3.6 Classification of turbine based on i) Head ii) Discharge iii) Direction of flow iv) Pressure v) Specific Speed
- 3.7 Governing of Turbine.
- 3.8 Advantages and limitations of Hydro-electric power plant
- 3.9 List of Hydro-electric Power Plants in India, Maharashtra

4 : Nuclear Power Plants:

4.1 Introduction

4.2 Basic definitions: Nuclear Fission, Fusion, Fissionable Materials, Fissile Material, Chain reaction, Moderators.

- 4.3 Fuels for nuclear fission reactor
- 4.4 Nuclear Energy Released by Fission
- 4.5 Site selection of nuclear power plant
- 4.6 Nuclear Reactor: basic component of nuclear reactor with function.
- 4.7 Types of nuclear reactor power plants.
- 4.8 General Layout of Nuclear power station.

4.9 Working of Nuclear Reactor: BWR-PP, PHWR-PP, and LM-FBR.

4.10 Nuclear reactor waste management.

- 4.11 Advantages and disadvantages of Nuclear power plant.
- 4.12 list of nuclear power plant in Maharashtra.
- 4.13 Comparison with thermal and Hydro-electric power

5 : Diesel Power Stations:

- 5.1 Introduction
- 5.2 General layout of Diesel Power Station.
- 5.3 Main component of Diesel power plant.
- 5.4 Major parts and working of Diesel Engine.
- 5.5 Applications of diesel power stations

6:Combined Cycle Power Plants

- 6.1 Introduction
- 6.2 General layout of combined cycle power plant.
- 6.3 major component of combined cycle power plant.
- 6.4 Advantages and disadvantages of combined cycle power plant
- 6.5 Applications of combined cycle power plant.
- 6.6 Example of combined cycle power plants in India

7: Economics Of Power Generation:

- 7.1 Connected load, Actual load, Load-curve, Load duration curve, Integrated load duration curve. (Simple numerical)
- 7.2 Definition of following: Plant Factor and reserves, Maximum demand factor, Load Factor, Diversity Factor, plant factor, capacity factor, connected load factor (Simple numerical)
- 7.3 Concept of Load forecasting: short term and long term.
- 7.4 Cost of Generation: Power Project cost Fixed, Running, Annual, Break even
- 7.5 Tariffs: definition, types, factors deciding tariffs structure. (Simple Numerical)
- 7.6 Interpretation of electric bills. (Domestic and Industrial)

Note: Visit to minimum two types of power plants with report writing.

Suggested specification table with Hours and Marks (Theory)

Unit		Teaching	Distribution of Theory Marks					
No	Topic Title	Hours	R Level	U Level	A Level	Total Marks		
1	Introduction	04	2	2		4		
2	Thermal Power Station	18	4	8	6	18		
3	Hydro-Electric Power plant	12	4	4	4	12		
4	Nuclear Power Plant	12	4	4	4	12		
5	Diesel Power Station	04	2	4		6		
6	Combined Cycle Power Plant	04	2	4		6		
7	Economics Of Power Generation	10	4	4	4	12		
		64	22	30	18	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 Systems by Dr. S. L. Uppal and Prof. S. Rao, Publisher: Khanna Publishers, New Delhi.
- 2. Principals of Power Systems by V. K. Mehta and Rohit Mehta, Publisher: S. Chand and Co. Ltd., New Delhi.
- 3. Non-Conventional Energy Sources by G. D. Rai, Publisher: Khanna Publishers, New Delhi.

Course Curriculum Development Committee:

- a. Internal Faculty
 - i. Miss. Ashwini V Patil
 - ii. Dr.P.N.Padghan
- b. External Faculty
 - i. Mrs B. S. Motling

Head of Department (Electrical Engineering)

Principal Govt. Polytechnic, Mumbai

CO Vs PO Matrix (EE 16302)

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 210.1	3	3	2	3	1	2	-	-	-	3
EE 16 210.2	3	3	2	3	2	2	1	-	-	3
EE 16 210.3	3	3	2	2	2	2	1	-	-	3
EE 16 210.4	3	3	2	2	2	3	1	-	-	3
EE 16 210.5	3	3	3	3	3	2	1	-	-	3
Avg. of POs	3	3	2	3	2	2	1			3

CO Vs PSO Matrix (EE 16302)

СО	PSO1	PSO2	PSO3
EE 16 210.1	2	2	2
EE 16 210.2	3	2	3
EE 16 210.3	3	2	2
EE 16 210.4	3	2	3
EE 16 210.5	3	3	2
Avg. of PSOs	3	2	2

Programme Code: EE									
Course Code: ME16203 Course Title: Elements Of Mechanical Engineering									
Compul	sory/Optio	nal	Compulse	ory					
Teaching Scheme and Credi			Credits		Ex	aminatior	Scheme		
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
02		02	04					50 (PA)	50

Rational: Student belonging to electrical engineering is made to learn some fundamentals of mechanical engineering so that they will have basic understanding of mechanical systems, equipments and processes. Finally, it develops the basic knowledge that is so essential to the creation of successful technician.

Course Outcomes: Student should be able to,

C01	Describe construction, working and principles of turbines, pumps &I.C.Engines.
	Acquire knowledge of mechanical engineering
CO2	Describe the scope of mechanical engineering with multidisciplinary industries.
CO3	Describe and identify common machine element with their functions and power transmitting devices.
CO4	Describe construction and working of boilers and turbines
CO5	Describe construction and working of hydraulic pumps and air compressors.
CO6	Describe construction and working refrigeration and air conditioning equipments.

Торіс	Hours	Marks
1.Prime Movers:	06	10
1.1Introduction.		
1.2Typesof prime movers.		
1.3Workingprincipleofexternal combustion engines.		
1.4WorkingprincipleofInternal Combustionengines-Constructionandworking of		
two strokeandfourstrokepetrol and diesel engines.		
1.5Selection of prime movers for applications-Hydraulic pump, air compressor, electric generator, automobile.		

2. BoilersandTurbines:	06	10
 2.1Introduction. 2.2Conceptoftemperature, heat, and thermal resistance. 2.3Modesof heat transfer- Conduction, convection, and radiation. 2.4Steamgeneration–Typesof boilers, boiler mountings and accessories, Types of steam condensers, steam turbines and feed water pumps 		
3.HydraulicPumps and Air Compressors:	04	08
3.1Introduction.		
3.2Typesof hydraulic pumps.		
3.3Constructionandworkingof centrifugal pump and reciprocating pump.		
3.4Selection of pump for different combinations of head and discharge.		
3.5Usesof compressed air.		
3.6Constructionandworkingof single stage reciprocating compressor.		
3.7Constructionandworkingof screw compressor.		
4.IntroductiontoRefrigerationandAirconditioning: 4.1Introduction.	04	06
4.2Vapourcompressioncycle – Block diagram and components used in VCC.		
4.3Propertiesofmoistair.		
4.4Psychometric processes.		
4.5Constructionandworkingof window airconditioner and split airconditioner.		
5.MechanicalDrives and mechanisms: 5.1Mechanisms:	08	10
5.1.1 Definition		
5.1.2 machine and structure difference		
5.1.3 four bar mechanism and slider crank mechanism		
5.1.4 introduction to inversion of mechanism		
5.2 Mechanical Drives:		
5.2.1Typesof power transmission drives- Belt, rope, chain and gear drives.		
5.2.2Advantages and disadvantages of Belt, rope, chain and gear drives.		
5.2.3Machineelementsused in motion and power transmission- shaft, bearings, coupling, pulleys, and gears.		
5.2.4Typesofshaft, bearings, couplings, pulleys, and gears.		

5.2.5Briefdiscussion brakes, clutches and their types.		
6.Industrial hydraulics and pneumatics: 6.1 Introduction	04	06
6.2 Industrial hydraulics and pneumatics.		
6.3Components of hydraulic and pneumatic circuits.		
6.4Hydrauliccircuit for shaper.		
6.5Pneumaticcircuit for speed control of air motor.		

Suggested Specifications Table with Hours and Marks (Theory):

			Distribution of Practical Ma			
Unit No	Topic Title	Teaching Hours	R Level	U Level	A Level	Total Marks
1	Prime Movers	06	02	04	04	10
2	Boilers and Turbines	06	02	04	04	10
3	Hydraulic Pumps and Air Compressors	04	02	04	02	08
4	Introduction to Refrigeration and Air-conditioning	04	02	04	-	06
5	Mechanical Drives and mechanisms	08	02	04	04	10
6	Industrial hydraulics and pneumatics	04	-	02	04	06
	Total	32	10	22	18	50

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 /Tutorials/Assignments/Visits:

Sr.	Unit	Practical /Tutorials/Assignments/Visits:	Approx.
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No.			Hours
1	III	Study of hydraulic power plant.	02
2	Ι	Study of thermal power plant.	04
3	Ι	Study of four stroke diesel engine–construction working of four stroke diesel engine.	04
5	Ι	Study of different types of boilers	04
6	II	Study of boiler mountings and accessories.	02
7	III	Pumps- Selection of appropriate pump	02
8	III	Study of centrifugal pump	02
9	IV	Study vapours compression refrigeration cycle	04
10		Study of window air conditioner	02
11		Study of power transmitting elements: couplings, gears, and bearings.	02
		Total	32

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Basic mechanical engineering	G.Shanmugam, S. Ravindram	TataMcGrawHill
2	Elements of mechanical engineering	C.S. Chetankumar	S.Chand&Co. Ltd.
3	Engineering Thermodynamics	S.Domkundwar	S.Chand&Co. Ltd.
4	Engineering Thermodynamics	P. K.Nag	TataMcGrawHill
5	Theory of Machines	R. S. Khurmi andJKGupta	S.Chand&Co.Ltd.

Course Curriculum Development Committee:

a. Internal Faculty

1. Mr. E.C. Dhembare

- 2. Mr.A.D.Kurumbhate
- 3. Mr.Y.B.Jamnik
- b. External Faculty

1. Mr. G.S.Dharme (Fr. Agnel Technical College Bandra)

Academic Coordinator	Head of Department	Principal
	(Mechanical Engineering)	Govt. Polytechnic Mumbai

CO VsPO matrix

C01	Describe construction, working and principles of turbines, pumps &I.C.Engines.
	Acquire knowledge of mechanical engineering
CO2	Describe the scope of mechanical engineering with multidisciplinary industries.
CO3	Describe and identify common machine element with their functions and power transmitting devices.
CO4	Describe construction and working of boilers and turbines
CO5	Describe construction and working of hydraulic pumps and air compressors.
CO6	Describe construction and working refrigeration and air conditioning equipments.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	2				2	3
CO2	2	2	3	2	2				2	2
CO3	2	2	3	2	2				2	3
CO4	2	3	3	2	2				2	3
CO5	2	3	3	2	2				2	3
CO6	2	3	3	2	2				2	3

CO Vs PSO matrix

	CO/POs	PSO1	PSO2
CO1	Describe construction, working and principles of turbines, pumps &I.C.Engines.	1	2
CO2	Acquire knowledge of mechanical engineering	1	1
CO3	Describe the scope of mechanical engineering with multidisciplinary industries.	1	1
CO4	Describe and identify common machine element with their	2	2

	functions and power transmitting devices.		
CO5	Describe construction and working of boilers and	1	1
	turbines		
CO6	Describe construction and working of hydraulic pumps	1	1
	and air compressors.		

Government Polytechnic, Mumbai

Course	e Code:	HU161	04	Course Title	e: Enviror	nmenta	I Studies		
Compu	lsory /	Optiona	l: Compu	lsory					
Teach	ing Sch	eme and	d Credits		Exa	aminati	on Schem	е	
TH	TU	PR	Total	TH	TS	PR	T OR	TW	
	2		2				ON	IW	1 ota
	4		2			-	25*	25 [@]	5

oral exam shall be based on the Term Work

^e TW shall be based on tutorial

Rationale:

n

Environmental studies is the interdisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. It is a broad field of study that includes also the natural environment, built environment, and the sets of relationships between them. The turn of the twentieth century saw the gradual onset of its degradation through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife by our callous deeds without any concern for the well-being of our surrounding. We are today facing a grave environmental crisis. It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could possibly be the remedies or precautions which need to be taken to protect the environment.

Course Outcomes:

Student should be able to

C01	State importance of environment
C02	Identify key issues about environment
CO3	Analyze the reasons for environment degradation
CO4	Distinguish the various improvement methods
CO5	Identify measures taken by the world bodies to restrict and reduce degradation

Course Content Details:

Unit No	Topics / Sub-topics					
1	Nature of Environmental Studies:					
	1.1 Definition, Scope and Importance of the environmental studies					
	1.2 Importance/significance of the environmental studies irrespective of course					
	1.3 Need for creating public awareness about environmental issues					
	1.4 Ways/means/methods of creating public awareness					
	1.5 Some important terms related with Environmental Studies					

Environmental Studies

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Civil Engineering

2	Natural Resources and Associated Problems:
2	
	2.1 Introduction
	2.2 Renewable Resources
	2.3 Forest Resources:
	o General description of forest resources
	o Functions and benefits of forest resources
	• Effects on environment due to over exploration of forest reconcern
7	Due to timber extraction
	Due to dams
	 Due to building of waterways
	Due to building of water ways
	2.4 Water Resources:
	o Hydrosphere: Different sources of water.
	Use and overexploitation of surface and ground water
	o Effect of floods, draught, dams etc. on water resources and
	community
	2.5 Mineral Resources:
	o Categories of mineral resources
	o Basics of mining activities
	o Mine safety
	 Effect of mining on environment
	2.6 Food Resources:
	 Food for all (Food Security)
	o Effects of modern agriculture
	• World food problem
	• Case Study: Adverse environmental effect of Black a rungar Ball
	R
3	Ecosystems:
	3.1 Concept of Ecosystem
	3.2 Classification
	3.3 Structure and functions of ecosystem:
	Structure (Components), Functions & Food Chain
	3.4 Energy flow in ecosystem:
	Gross primary product and Net primary product, Autotrophic levels
	and Bioaccumulation
	3.5 Major ecosystems in the world
	3.6 Case Study: Silent Spring
4	Biodiversity and Its Conservation:
	to D. C. Him of Diadivarity
	4.1 Definition of Blodiversity
	4.2 Levels of blodiversity.

Environmental Studies

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	Genetic, Species, Community & Ecosystem
	4.3 Value of biodiversity
	4.4 Threats to biodiversity:
	Habitat destruction, Invasive species, Genetic pollution,
	Overexploitation, Hybridization, Climate change & Overpopulation
	4.5 Conservation of biodiversity: In-situ & Ex-situ
	4.6 Case Study of any two endangered species
5	Environmental Pollution:
	5.1 Definition of environmental pollution
	5.2 Air pollution:
	a. Definition
	b. Classification: Types of air pollution, Types of air pollutants
	c. Sources: Anthropogenic & Natural
	d. Effects: Health effects, Climate change, Global warming, Acid rain,
	Ozone layer depletion & Photochemical smog
	e. Prevention: Particulate control, Scrubbers, NOx control, VOC
	abatement, Acid gas control & Mercury control
-	5.3 Water Pollution:
	a. Definition
	b. Water trivia facts
	c. Water pollution trivia facts
	d. Classification: Surface, Groundwater, Oxygen depletion in waters,
	Nutrient pollution, Microbiological pollution, Suspended matter & Chemical pollution
	e. Sources/Causes of pollution: Sewage & waste water, Marine
	dumping, Industrial waste water, Nuclear waste, Oil pollution,
	Underground storage leakages, Atmospheric deposition and
	Eutrophication
	f. Effects of water pollution
	g. Prevention (What you can do)
	h. Treating water pollution, Water pollution at home
	5.4 Soil Pollution: Definition sources, effects, prevention
	5 ¹⁵ Noise Pollution: Definition sources, effects, prevention
	5.6 Case Study: Bhopal Gas Tragedy and Minamata Disease
6	Social Issues and Environment:
	6.1 Concept of development
	6.2 Sustainable development: Environmental, Economic, Social & Cultural

Environmental Studies

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Academ	nic Co-ordinator

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Civil Engineering

2.	Visit to Urban/Rural/Indu	a strial/Agri	local cultural	polluted	site:	
3.	Study of common Study of simple ed Weightage in Terr	plants, in cosystems n Work m	sects, bird of ponds, arks 05	s river, hill slop	es etc	
					Total	32

References/ Books:

Sr. No.	Author	Title	Publisher
01	Anindita Basak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India

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Head of Department (Civil Engineering)

Principal Govt. polytechnic Mumbai

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Environmental Studies

Programme : Diploma in Electrical Engineering											
Course Code: EE 16 211 Course Title: Electrical Circuits and Network											
Compuls	Compulsory / Optional: Compulsory										
Teach	Teaching Scheme and Credits Examination Scheme										
TH	TU	PR	PR Total TH TS PR OR TW Total								
03	02	02	07	70 (3 Hrs)	70 (3 Hrs) 30 50* - 50 200						

(*) - indicates assessment by External examiner

Rationale:

Students of electrical engineering must know different types of circuits networks and related concepts. It is also necessary that, they should be able to apply appropriate laws or theorems to analyse the various circuits. This is one of the foundation courses which is required to understand the concepts of advanced courses and develop skills that are needed in Electrical field.

Course Outcomes:

EE 16 211.1	Define different terminologies related AC circuits and Poly-phase circuits.
EE 16 211.2	Analyse simple linear DC networks and AC circuit using basic methods and theorem.
EE 16 211.3	Compare the behaviour of resistive inductive and capacitive circuit when AC voltage is applied.
EE 16 211.4	Draw phasor diagram for resistive inductive and capacitive circuit.
EE 16 211.5	Distinguish between active, reactive and apparent power.
EE 16 211.6	Compare star and delta connected system.

Unit No.	Topics/Subtopics								
1	DC Network theorem:								
	1.1 Network Analysis : Direct method, Network reduction method.								
	1.2 Statement, Explanation, and simple Numerical on following theorem.								
	a) Mesh/Loop analysis								
	b) Nodal analysis								
	c) Superposition theorem								
	d) Thevenin's theorem.								
	e) Nortons's theorem.								
	f) Maximum Power Transfer Theorem.								
	g) Star Delta transformation								

2	AC Fundamentals :
	 2.1:Difference between a.c. and d.c. quantity, Advantages of a.c. over d.c. ,Generation of alternating voltages and currents, Mathematical expression of alternating quantity. 2.2 Definition of : Waveform, Instantaneous Value, cycle, Alternation, Time period, frequency, amplitude. 2.3 :Relationship between a) Time period and frequency b) Angular velocity and frequency c) Frequency and speed 2.4 : Different forms of equation of alternating voltage. 2.5 Definition of : Peak value, Average value, RMS value, form factor, peak factor for sinusoidal voltage and current. 2.6 : Concept of phase, phase difference, lagging and leading phasor, Phasor representation of sinusoidal quantity. Numericals based on above
3	Phasor Algebra :
	3.1Mathematical representation of phasor
	a) Symbolic Notation, significance of operator j.
	b) Trigonometric form
	c) Exponential form
	d) Polar form 2.2 Conversion from polar to rectangular form and vice verse
	3.3 Addition Subtraction Multiplication and division vector
	Numerical based on above
4	AC series circuit :
	4.1 AC through pure resistance: Circuit, Equation, waveform,
	Phasor diagram, Average power.
	4.2 AC through pure Inductance : Circuit, Equation, waveform, Phasor diagram,
	Inductive reactance ,Average power.
	4.3 AC through pure capacitance : Circuit, Equation, waveform, Phasor diagram,
	Capacitive reactance, Average power.
	4.4 Series KL, KC and KLC circuit. Circuit, phase angle, impedance, Admittance, Average power. Power curve
	4.5 Voltage triangle. Impedance triangle. Power triangle. Apparent power. True Power.
	Reactive power.
	4.6 Resonance in RLC series circuit: Derivation of resonance frequency, Effect of
	frequency on R,XL,XC, Z and current, quality factor, resonance curve .
_	Numerical based on above
5	AC Parallel Circuit :
	5.1 Concept of parallel circuit.
	5.2 Admittance, susceptance and conductance.
	5.4 Calculation of current, power, power factor in A.C. parallel RL RC and RLC circuits.
	(Numerical based on above.)
	5.5 Condition and characteristics of parallel resonant circuit, Resonance curve,
	Comparison with series resonance, Quality factor of parallel resonant circuit .
6	Polyphase Circuits:
	6.1Difference between single phase and polyphase system, Generation of three-phase
	a.c. supply, Advantages of three-phase supply over single-phase supply.
	6.3 Star connected system Relation between phase and line values of current and voltage
	in balanced Star system.
	6.4 delta connected system ,Relation between phase and line values of current and voltage

in balanced Delta system.
6.5 Active, Reactive and Apparent power in three phase Star/Delta system.
6.6 Advantages of star and delta connected system
(Numerical based on above.)

Suggested specification table with Hours and Marks (Theory)

Unit		Teaching	Distribution of Theory Marks				
No	Topic Title	Hours	R Level	U Level	A Level	Total Marks	
1	DC Network Theorem	14	08	10	4	22	
2	AC Fundamentals	06	04	04	00	08	
3	Phasor Algebra	04	02	03	00	05	
4	AC Series Circuit	10	06	06	04	16	
5	AC Parallel Circuit	08	03	03	04	10	
6	Polyphase Circuit	06	05	04	00	09	
		48	28	30	12	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.

Sr.	Unit	Experiment/Assignment	Approx
No.			nours
1	1	Verify Superposition theorem applicable to D.C. circuit.	04
2	1	Verify Thevenin's theorem applicable to D.C. circuit.	02
3	1	Verify Norton's theorem applicable to D.C. circuit.	02
4	2	Verify the maximum power transfer Theorem applicable to D.C. & A.C. circuit.	02
5	2	Observe AC and DC waveform on CRO and find magnitude of DC voltage, peak average, R.M.S. values and frequency of AC voltage,	02
6	4	Observe response of " Inductor" and " Capacitor" to A.C. voltage	04
7	4	Determine impedance, phase angle of R-L series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in R-L series circuit.	04
8	4	Determine impedance, phase angle of R-C series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in R-C series circuit	04

List of Practical (Any Ten)

9	4	Determine impedance, phase angle of RLC series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in RLC series circuit	04
10	4	Obtain resonance in R-L-C series circuit.	04
11	5	Find the current and power factor in R-L parallel Circuit.	04
12	5	Find the current and power factor in R-C parallel Circuit.	04
13	5	Find the current and power factor in R-L-C parallel Circuit.	04
14	5	Obtain resonance in R-L-C parallel circuit.	04
15	6	Verify relationship between line and phase values of voltage and current in star connected balanced load	02
16	6	Verify relationship between line and phase values of voltage and current in delta connected balanced load	02

Reference Books:

Sr. No.	Book Title	Author	Publication
1	Electrical Technology Volume-I	B. L. Theraja	S. Chand and Co. Ltd., New Delhi.
2	Basic Electrical Engineering	V.K. Mehta, Rohit Mehta	S. Chand and Co. Ltd., New Delhi.
3	Circuit and Network	V.N. Mittle,	Tata McGraw Hill
4	Schaum online series Theory and problems of Electric circuits	Edminister,	T. M. G. H., New York
5	Engineering Circuit Analysis	W. H.Hyat and J. E. Kemmerly	T.M.G.H., New York

Course Curriculum Development Committee:

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- ii. Mr. A.K. Dhulshette
- iii. Dr. P.N .Padghan

b. External Faculty

i. Mrs Jyoti Naik G.P. Thane

Academic Coordinator

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

CO Vs PO Matrix:

СО	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 211.1	3	3	2	0	0	0	0	1	0	3
EE 16 211.2	3	3	3	3	3	0	0	1	0	3
EE 16 211.3	3	3	3	3	3	0	0	1	0	3
EE 16 211.4	3	3	3	3	3	0	0	1	0	3
EE 16 211.5	3	3	3	3	2	0	0	1	0	3
EE 16 211.6	3	3	3	3	3	0	0	1	0	3

CO Vs PSO Matrix:

СО	PSO1	PSO2	PSO3
EE 16 211.1	3	3	0
EE 16 211.2	3	3	0
EE 16 211.3	3	3	3
EE 16 211.4	3	3	0
EE 16 211.5	3	3	3
EE 16 211.6	3	3	3

Programme : Diploma in Electrical Engineering									
Course Code: EE 16 212 Course Title: D.C. Machine & Transformer									
Compul	Compulsory / Optional: Compulsory								
Teach	Teaching Scheme and Credits Examination Scheme								
TH TU PR Total TH TS PR OR TW Total									
3	2 2 7 70 (3 Hrs.) 30 50* 50 200								

1. RATIONALE :

The knowledge of DC machines including their characteristics is necessary for students of Electrical Engineering. The subject deals with the concepts, characteristics & applications of DC Generators & Motors. A diploma holder has to work in various fields such as manufacturing industries, State Electricity boards, Power Generation Stations, etc. His work involves operation control and maintenance of electrical machines. He should therefore know the working principle, constructional features, and performance of AC machines. Transformer is one of the most important devices of electrical power system. It has imparted more flexibility to AC system than DC system, due to which the AC system is widely preferred over DC system in most of the applications. Since technicians are expected to work with various electrical / electronic systems involving transformer, it is highly essential to provide them necessary knowledge about construction, operation & testing of transformer with mathematical background. This course aims at strategic development of students so that they can understand, operate, use & test the transformer as per the requirement.

Course Outcomes:

EE 16 212.1	State the principle of electromechanical energy conversion
EE 16 212.2	State working principle and identify the different parts of DC generator, DC motor and Transformer
EE 16 212.3	Clarify material used for different parts of DC generator, DC motor and Transformer,
EE 16 212.4	Compare different types of DC Generators, DC Motor and transformers
EE 16 212.5	Compare the characteristics of various DC generator and DC motors
EE 16 212.6	Solve Equivalent circuit and find losses, voltage regulation and efficiency of transformer
EE 16 212.7	Select proper DC machine and transformer for particular application

Unit	Topics/Subtopics
No.	
	Introduction to D. C. Machine
1	1.1 Principles of Electromechanical Energy Conversion
	1.2 Necessity of DC machines
	1.3 Constructional parts of D. C. machine and their functions.
	1.4 Winding Terms: i. e. terms related to windings, types of armature windings,
	difference between Lap & Wave winding. (No Numerical)
	D. C. Generator.

2	2.1 Working principles of DC generators
	2.2 Types of DC generators.
	2.3 E. M. F. equation & voltage equation of DC generator
	2.4 Losses in DC generator
	2.5 Power stages of DC generator
	2.6 Characteristics of DC generators
	2.7 Armature reaction
	2.8 Commutation, methods to improve commutation.
	2.9 Applications of shunt, series and compound generator.
	(Simple numerals on above)
	D. C. Motor.
3	3.1 Working principle of DC motor
	3.2 Concept and significance of back emf.
	3.3 Torque expression, voltage equation, speed regulation
	3.4 Characteristics & applications of DC motor, (shunt, series compound)
	3.5 Power Stages in D. C. Motor (Numerical)
	3.6 Speed control of D. C. Motor (Numerical)
	3.7 Starters of DC motor- Necessity, Three & Four point starter, simple numerals on
	above.
	Single phase transformer.
4	4.1 Introduction, Working principle of transformer,
	4.2 Constructional parts and their functions.
	4.3 Materials used for construction.
	4.4 Classification of transformer.
	4.5 EMF equation of transformer (derivation), Transformation ratio,
	4.6 Concept of ideal transformer.
	4.7 Transformer on no load- Vector diagram & numerical.
	4.8 Transformer on load – phasor diagram of loaded transformer
	4.9 Magnetic leakage and kVA capacity of transformer.
	4.10 Equivalent circuit diagram of transformer.
	4.11 Efficiency & Losses in Transformer and regulation of transformer
	4.12 Method to find losses and efficiency and regulation of transformer (OC & SC
	test).
	4.13 All day efficiency of 1-phase transformer.
	4.14 Single phase Autotransformer, principles, advantages and disadvantages
	4.15 Polarity of transformer.
	4.16 Isolation Transformer
	4.17 Simple numerals on above
_	Three Phase transformer.
5	5.1 Construction with function of each part.
	5.2 Connections & their importance
	5.3 Vector groups
	5.4 Three Phase auto transformer
	5.5 Applications of all types (Numerical on calculations of V, I & kVA capacity)
	5.6 Concept and fundamentals of instrument transformer

Suggested specification table with Hours and Marks (Theory)

Unit No	т. • т .ч.1	Teaching	Distribution of Theory Marks			
	lopic little	Hours	R	U	Α	Total
			Level	Level	Level	Marks
1	Introduction to D. C. Machine	04	04	02	00	06
2	D. C. Generator.	10	04	06	04	14
3	D. C. Motor.	10	06	06	04	16
4	Single phase transformer.	16	08	12	04	24
5	Three Phase transformer	08	06	04	00	10
		48	28	30	12	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.

A. List of Experiments

Sr.	Unit	Experiment/Assignment	Approx
No.	No.		Hours
1	1	Write a Report on the machine Laboratory in terms of practicing of	02
		reading name plates of various machines and their supply system.	
2	1	To study the constructional parts of D. C. Machine.	02
3	2	To plot Load characteristic of D. C. shunt generator.	02
4	3	Speed control of DC shunt motor using Flux Control & Armature	02
		Voltage Control method.	
5	3	To reverse directions of rotation of D. C. shunt motor.	02
6	3	Load test on D. C. shunt motor & calculation of efficiency, output,	04
		torque etc.	
7	4	To find transformation ratio of single phase transformer.	02
8	4	Determine the efficiency & regulation of single phase transformer by	04
		Direct loading.	
9	4	To perform O. C. & S. C. test on single phase transformer for finding	04
		efficiency & regulation of transformer.	
10	5	Study the constructional details of distribution & power transformers.	08
		(based on visit to transformer manufacturing industry)	

Books:

Sr.	Name of Book	Author	Publisher		
No.					
1	Performance & Design of A.C.	M.G. Say	C.B.S. Publications, New Delhi		
	Machine				
2	A Text Book Of Electrical	B.L. Theraja	S. Chand & Co.		
	Technology vol-II	A.K. Theraja			
3	Electrical Machines.	Nagrath & Kothari	Tata McGraw-Hill Co. New Delhi		
4	Electrical Technology	Edward Hughes	Pearson Education, New Delhi		
5	Electrical Machines	S.K. Bhattacharya	Tata McGraw-Hill Co. New Delhi		

Websites:

- 1. www.nptel.com
- 2. www.electrical4u.com/
- 3. electrical-engineering-portal.com
- 4. <u>www.learnerstv.com</u>

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CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO										
EE 16 212.1	3	3			2				1	3
EE 16 212.2	3	3			2				1	3
EE 16 212.3	3	3	2	1	2	1		2	1	2
EE 16 212.4	3	3	3	3	1	1		2	1	2
EE 16 212.5	3	3	2	2	2	1		2	1	2
EE 16 212.6	3	3	3	2	3	2		2	1	2
EE 16 212.7	3	3	2	2	1	1		2	1	2
Avg. of POs	3	3	2	2	2	1		2	1	2

CO Vs PSO matrix

СО	PSO1	PSO2	PSO3
EE 16 212.1	3	1	2
EE 16 212.2	3	1	2
EE 16 212.3	3	2	2
EE 16 212.4	3	1	2
EE 16 212.5	3	2	2
EE 16 212.6	3	1	2
EE 16 212.7	2	2	2
Avg. Of PSOs	3	1	2