



Government Polytechnic, Mumbai

Department of Electrical Engineering

**P-19 Curriculum
(Sandwich Pattern)**

**Semester-III
(Course Contents)**

GOVERNMENT POLYTECHNIC MUMBAI
(Academically Autonomously Institute, Government of Maharashtra)
Teaching and Examination Scheme (P19)
With effect from AY 2019-20

Programme: Diploma in Electrical Engineering (Sandwich Pattern)

Term / Semester - III

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
HU 19 102	Environmental Studies	--	--	2	02	02	--	--	--	--	25	25	50
EE 19 207	Electrical Power Generation	4	--	--	04	04	60	20	20	--	--	--	100
EE 19 208	Electrical Circuit & Network	4	2	2	08	08	60	20	20	50*	--	25	175
EE 19 209	DC Machine & Transformer	4	2	--	06	06	60	20	20	50*	--	25	175
EE 19 302	Electrical Transmission & Distribution	4	2	--	06	06	60	20	20	50*	--	25	175
EE 19 303	Linux [#] (Spoken Tutorial)	--	--	4	04 [#]	04 [#]	--	--	--	--	--	--	--
	Total	16	06	08	30	30	240	80	80	150	25	100	675
Student Centered Activity (SCA)					05								
Total Contact Hours					35								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

* Indicates assessment by External Examiner else internal assessment, # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour, TH- 2 hours, PR/OR – 3 hours per batch, SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours
Self, on- line learning Mode through MOOCs /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Department Coordinator,
Curriculum Development,
Dept. of Electrical Engineering

Head of Department
Dept. of Electrical Engineering

In-Charge
Curriculum Development Cell

Principal

Programme : Diploma in CE/EE/EC/CO/IT/IS/LG/LT (Sandwich pattern)										
Course Code: HU19102				Course Title: Environmental Studies						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	02	--	02	--	--	--	--	25	25	50

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Technicians working in industries or elsewhere essentially require the knowledge of environmental Studies so as to enable them to work and produce most efficient, economical and eco-friendly finished products. Solve various engineering problems applying ecosystem to produce eco – friendly products. Use relevant air and noise control method to solve domestic and industrial problems. Use relevant water and soil control method to solve domestic and industrial problems. To recognize relevant energy sources required for domestic and industrial problems. Solve local solid and e-waste problems.

Course Outcomes: Student should be able to

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Understand the suitable air, extent of noise pollution, and control measures and acts.
CO3	Understand the water and soil pollution, and control measures and acts.
CO4	Understand different renewable energy resources and efficient process of harvesting.
CO5	Understand Solid Waste Management & E Waste Management, ISO 14000, 45001 & Environmental Management.

Course Content Details:

Unit No	Topics / Sub-topics
1	Ecosystem
	1.1 Structure of ecosystem, biotic & Abiotic components
	1.2 Food chain and food web
	1.3 Aquatic (Lentic and Lotic) and terrestrial ecosystem
	1.4 Carbon, Nitrogen, Sulphur, Phosphorus cycle
	1.5 Global warming -Causes, effects, process, Green House Effect, Ozone depletion
	Course Outcome: CO1 Teaching Hours : 6 hrs Marks: 03 (R- NA, U-NA, A- NA)
2	Air and Noise Pollution
	2.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)
	2.2 Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone

	separator, Electrostatic Precipitator) 2.3 Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler 2.4 Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution Course Outcome: CO2 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)
3	Water and Soil Pollution 3.1 Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition 3.2 Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis) 3.3 Causes, Effects and Preventive measures of Soil Pollution : Causes – Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-waste 3.4 Mangroves : Importance, benefits. Course Outcome:CO3 Teaching Hours : 6 hrs Marks: 05 (R- NA, U-NA, A- NA)
4	Renewable sources of Energy 4.1 Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. 4.2 Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas 4.3 Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy 4.4 New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy Course Outcome:CO4 Teaching Hours : 6 hrs Marks:05 (R- NA, U-NA, A- NA)
5	Solid Waste Management OR E- Waste Management, ISO 14000 & Environmental Management For Civil Engineering : 5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste. 5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste 5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act1996. Structure and role of Central and state pollution control board. 5.4 Concept of Carbon Credit, Carbon Footprint. 5.5 Environmental management in fabrication industry. 5.6 ISO14000: Implementation in industries, Benefits, ISO 45001:2018 5.7 Role of MPCB in factory permit. 5.8 Green pro IGBC certification, its benefits OR For Computer Engineering & Information Technology : 5.1 E-Waste Electronic products which have become unwanted, non-working, obsolete 5.2 E-Waste Management Services 5.3 Separation of E-Waste from other waste

	5.4 Categorization of E-Waste into old working equipments, old computers, non-working components
	5.5 Authorized Recycling Facilities
	5.6 Refurbishing
	OR
	For Electrical Engineering :
	5.1 Various e-waste sources, their constituents, and health impacts
	5.2 e-Waste Problem in India
	5.3 Initiatives on building awareness in e-waste management.
	5.4 Current Status of e-Waste Management & Environmental (Protection) Act 1986
	5.5 Development of waste recycling technologies.
	5.6 Opportunities of e-Waste Management in India
	5.7 e-Waste Management techniques
	OR
	For Electronics Engineering & Instrumentation Engineering :
	5.1 Solid waste generation- Sources and characteristics of : E- waste, biomedical waste.
	5.2 Toxicity due to hazardous substances in E waste and their impact
	5.3 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.
	Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste
	5.4 Domestic E waste disposal and E waste management
	5.5 Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996. Structure and role of Central and state pollution control board.
	5.6 Concept of Carbon Credit, Carbon Footprint.
	OR
	For Leather Technology/ Leather Goods & Footware Technology :
	5.1 Solid waste generation- Sources and characteristics of : Municipal solid waste, E- waste, biomedical waste.
	5.2 Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.
	Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste
	5.3 Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996. Structure and role of Central and state pollution control board.
	5.4 Concept of Carbon Credit, Carbon Footprint.
	5.5 Environmental management in fabrication industry.
	5.6 ISO14000: Implementation in industries, Benefits.
	5.7 Solid waste management in leather and footwear industries
	Course Outcome:CO5 Teaching Hours : 6 hrs Marks:07(R- NA, U-NA, A- NA)

Note : Chapter 5 should be teach as per department mentioned.

List of tutorials:

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1,2,3, 4,5	CO1,CO2, CO3,CO4, CO5	Prepare a write up on each unit (altogether 5 in number) that summarizes the whole unit and presents important points on it.	14
2	2,3	CO2,CO3	Visit to a local polluted site : Urban/Rural/Industrial/Agricultural and prepare a report	4

			based on visit.	
3	4	CO4	Visit to biomass plant and prepare a report based on visit.	6
4	5	CO5	Visit to municipal solid waste management organization or an authorized e-waste recycling plant and prepare a report based on visit.	6
Total				30

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Environmental Studies	S.C. Sharma & M.P. Poonia Khanna Publishing House, New Delhi	ISBN: 978-93-86173-09-6
2	Understanding Chemistry	C.N.Rao Universities Press(India) Pvt. Ltd. 2011	ISBN:13-9788173712500
3	Waste water treatment for pollution control and reuse	Arceivala, Soli Asolekar, Shyam Mc-Graw Hill Education India Pvt. Ltd. New york, 2007	ISBN:978-07-062099
4	Elements of Environmental Pollution control	O.P.Gupta Khanna Publishing House, New Delhi	ISBN:13-9789382609667

E-References:

- 1) www.eco-prayer.org
- 2) www.teriin.org
- 3) www.cpcp.nic.in
- 4) www.cpcp.gov.in
- 5) www.indiaenvironmentportal.org.in
- 6) www.whatis.techtarget.com
- 7) www.sustainabledevelopment.un.org
- 8) www.conserve-energy-future.com
- 9) <http://www.nationallibrary.gov.in>

CO Vs PO and CO Vs PSO Mapping (Civil Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	1	1
CO3	3	3	2	2	3	3	3	--	1	1
CO4	3	3	2	2	3	3	3	--	1	1
CO5	3	3	2	2	3	3	3	--	1	1

CO Vs PO and CO Vs PSO Mapping (Electrical Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	3
CO2	3	3	2	2	3	3	3	--	--	2
CO3	3	3	2	2	3	3	3	--	--	2
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	2

CO Vs PO and CO Vs PSO Mapping (Electronics Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	2
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	2
CO5	3	3	2	2	3	3	3	--	--	1

CO Vs PO and CO Vs PSO Mapping (Instrumentation Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	2	1	3	3	3	--	--
CO2	3	3	2	2	3	3	3	--	--
CO3	3	3	2	2	3	3	3	--	--
CO4	3	3	2	2	3	3	3	--	--
CO5	3	3	2	2	3	3	3	--	--

CO Vs PO and CO Vs PSO Mapping (Computer Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	--
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Information Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	3	--
CO2	3	3	2	2	3	3	3	--	2	--
CO3	3	3	2	2	3	3	3	--	2	--
CO4	3	3	2	2	3	3	3	--	2	--
CO5	3	3	2	2	3	3	3	--	3	--

CO Vs PO and CO Vs PSO Mapping (Leather Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

CO Vs PO and CO Vs PSO Mapping (Leather Goods & Footware Technology)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	3	3	--	--	1
CO2	3	3	2	2	3	3	3	--	--	--
CO3	3	3	2	2	3	3	3	--	--	--
CO4	3	3	2	2	3	3	3	--	--	--
CO5	3	3	2	2	3	3	3	--	--	--

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rohan Deokar	Deputy Engineer	MMRDA
2	Mr. Sanjay Kulkarni	Surveyor and Consultant	SRKulkarni Pvt.Firm
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Ms. S. M. Male	Lecturer in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engg.

Head of Department
Department of Civil Engg.

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Electrical Engineering (Sandwich Pattern)										
Course Code: EE19207				Course Title: Electrical Power Generation						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 mts)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
4	-	-	4	60	20	20	-	-	-	100

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

Electrical Engineering Diploma holders employed in the field of power generation mostly works in large thermal, hydro power stations, non-conventional power plants and substation. Some may hold independent charge of small generating station and substation. All of them need to know the various primary sources of energy available, the process of energy conversion, equipment necessary for these processes, safety measures and their function.

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

Course Outcomes: Student should be able to

EE19207.01	Understand the types of power generation
EE19207.02	Interpret the layout of power plant
EE19207.03	Apply the knowledge of functioning of generating equipment for supervision and maintenance
EE19207.04	Apply safe practices in power plants

Course Content Details:

Unit No	Topics / Sub-topics
1	Thermal Power Plants: Coal based: 1.1 Energy conversion process of thermal power plant (A block diagram concept) 1.2 Layout and working of a typical thermal power plant 1.3 Properties of conventional fuels(coal) used in the energy conversion 1.4 Major Equipment used in thermal power plants with its function 1.5 Types of Boilers: Fire Tube Boilers and water tube boilers 1.6 Temperature and pressure of steam in modern power plant. Introduction to Super Critical Technology Thermal power plants 1.7 Safe Practices, observed in thermal power plants 1.8 Thermal power plants with capacity in Maharashtra

	Demonstration of video of working of thermal power plant Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours : 12 Marks: 12 (R- 4, U-4, A-4)
2	Nuclear Power Plant 2.1 Energy conversion process 2.2 Atomic fusion and fission action, commonly used nuclear fuels 2.3 Layout and working of a typical nuclear power plant 2.3 Major Equipment used in nuclear power plants and their function only 2.4 Disposal of nuclear waste and nuclear shielding 2.5 Safe Practices observed in typical nuclear power plant 2.6 Nuclear power plants with capacity at national and state level Demonstration of video of working of nuclear power plant Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours :06 Marks: 06 (R- 2, U- 2, A- 2)
3	Hydro Power Plants 3.1 Energy conversion process of hydro power plant 3.2 Layout and working of a typical hydro power plant 3.3 Major Equipment used in hydro power plants and their function only 3.4 Classification of hydro power plant and type of water turbine: High, medium and low head 3.5 Safe Practices observed in hydro power plants 3.6 Pumped Storage Hydro Power Plants 3.7 Hydro power plants with capacity in Maharashtra Demonstration of video of working of hydro power plant Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours :12 Marks:12 (R- 4, U- 4, A- 4)
4	Solar Power Plants 4.1 Solar Map of India: Global solar power radiation. 4.2 Energy conversion process of solar power plant 4.3 Solar Power Technology: Direct and indirect conversion to electrical energy. 4.3.1 Indirect Conversion – High temperature Concentrated Solar Power (CSP) Tower plants, Its layout and working. Functions of each component depicted in layout 4.3.2 Types of solar power collectors- Flat collectors, parabolic trough, parabolic dish, Fresnel reflectors, heliostat 4.4 Direct conversion – Brief introduction to photo voltaic cell, 4.4.1 Grid connected and battery storage Solar Photovoltaic (PV) power plant, layout, and working 4.4.2 Major Equipment used in PV solar power plants and their function only 4.4.3 Types PV System- Central Power station system, distributed system, stand alone, grid interactive, hybrid system, small system for consumer application 4.5 Safe Practices observed in solar power plants 4.6 Major Solar power plants with capacity at national and state level Demonstration of video of solar power plants Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours : 12 Marks:12 (R- 4, U-4, A- 4)

5	Wind Power Plants 5.1 Wind Map of India: Wind data and its unit of measurements, electrical power output 5.2 Types of wind turbine - Horizontal axis (HAWT) and Vertical axis wind turbine, main components of HAWT(only) 5.3 Salient Features of electric generators used in large wind power plants: 5.4 Names of different wind generators 5.5 General block diagram of wind energy conversion system 5.6 Safe Practices observed in wind power plants 5.7 Wind power plants with capacity in Maharashtra Demonstration video of wind power plant Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours : 10 Marks:10 (R-2, U-4, A-4)
6	Biomass-Power Plants 6.1 Energy conversion process of biomass-based power plant 6.2 Methods of Biomass conversion technology 6.3 Biomass gasification process, gasification plants-Schematic diagrams of downdraft, updraft, cross draft and fluidized bed type 6.4 Layout of a Thermo-chemical based (e.g. Municipal waste) power plant 6.5 Safe Practices observed in bio-mass based power plants 6.6 Biomass Power plant with capacity in Maharashtra Demonstration of video biomass power plant Course Outcome: EE19207.01, EE19207.02, EE19207.03, EE19207.04 Teaching Hours : 8 Marks: 8 (R-2, U-4, A-2)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Thermal Power Plants	4	4	4	12
2	Nuclear Power Plant	2	2	2	06
3	Hydro Power Plants	4	4	4	12
4	Solar Power Plants	4	4	4	12
5	Wind Power Plants	2	4	4	10
6	Biomass Power plants	2	4	2	08
Total		18	22	20	60

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Power Plant Engineering	Nag. P. K. McGraw Hill, New Delhi, 4 th Edition, 2017	978-9339204044
2	Electrical Power Generation	Tanmoy Deb, Khanna Publishing House, Delhi (Ed. 2018)	9789386173379
3	Generation of Electrical Energy	Gupta, B.R. S. Chand & Co. New Delhi, 2014	9788121901024
4	Non-Conventional Energy Resources	B. H. Khan, McGraw Hill, New Delhi, Third Edition, 2016	9789352601882, 9352601882
5	Solar Photovoltaic: Fundamentals, Technologies and Applications	Solanki, Chetan Singh PHI Learning, New Delhi Third edition, 2015	9788120351110
6	Wind Turbines	Hau, Erich, Springer-Verlag, Berlin Heidelberg, Germany	978-3-642- 27150-2
7	A Course in Electrical Power	Gupta J.B. S. K Kataria and Sons, New Delhi. 2014,	9350143747
8	A Course in Electrical Power	Soni, Gupta, Bhatnagar, Dhanpatrai and Sons New Delhi, 2005	9788121924962
9	Textbook of Renewable Energy	S.C. Bhatia, R. K. Gupta Woodhead Publishing India, 2018	9788193644607
10	Biomass to Renewable Energy Processes	Jay Cheng, CRC Press, 2 nd edition, 2017	9781498778794

E-References:

1. <https://ndl.iitkgp.ac.in/>
2. <https://blossoms.mit.edu>
3. <https://electrical-engineering-portal.com>
4. <http://electronics.wisc-online.com>
5. <https://www.electrical4u.com/>
6. <https://powermin.nic.in/>
7. <http://www.nhpcindia.com/>
8. <https://www.mahagenco.in/>
9. <https://www.ntpc.co.in/>
10. <https://www.npcil.nic.in/>
11. <https://www.seci.co.in/>
12. <https://mnre.gov.in/>
13. <https://www.mahaurja.com/meda>
14. <https://www.energy.gov/eere/>

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
EE19207.01	3	3	1	2	3	2	3	3	3	3
EE19207.02	3	2	2	3	3	2	3	3	3	3
EE19207.03	3	3	2	2	3	2	3	3	3	3
EE19207.04	3	2	2	2	3	2	3	3	3	3

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Sudesh N. Bhadange	SE, Hydro	Mahagenco, Prakashgad Bandra Mumbai
2	Narayan C. Amzare	SE, Nagpur Rural Circle	MSEDCL Nagpur
3	Barnalli Motling	HOD , Electrical Engineering	KJSP Vidyavihar , Mumbai
4	Nisha Wader	HOD, Electrical Engineering	VPM Polytechnic Thane
5	Sandeep Vishwarupe (Curriculum Content Designer)	HOD, Electrical Engg.	Govt. Polytechnic Mumbai
6	Ishwar Khuspe (Curriculum Content Designer)	Lecturer Electrical Engg.	Govt. Polytechnic Mumbai

Coordinator,

Curriculum Development,

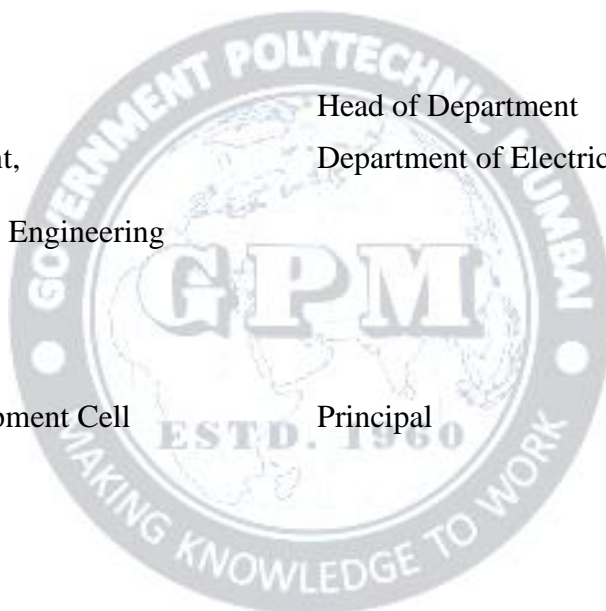
Department of Electrical Engineering

Head of Department

Department of Electrical Engineering

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Electrical Engineering (Sandwich Pattern)										
Course Code: EE 19 208				Course Title: Electrical Circuit & Network						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hr 30 Min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
4	2	2	8	60	20	20	50	--	25	175

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Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale: Knowledge of Electrical Circuits is essential in maintaining the electrical equipment. Understanding the layout of electrical circuits, their functioning and behaviour lays a foundation stone for an electrical engineer. This course will help the students to use the principles of circuit analysis in designing, maintaining the electrical circuits of equipment & wiring installations and discharge their duties as a supervisor where ever needed

Course Outcomes: Student should be able to

EE19 208.1	Describe the different parameters of single-phase series AC circuits, their inter relationships and behaviour.
EE19 208.2	Describe the different parameters of single-phase parallel AC circuits, their inter relationships and behaviour.
EE19 208.3	Describe the different parameters of polyphase AC circuits, their inter relationships and behaviour.
EE19 208.4	Apply different circuit analysis techniques and theorems to solve basic circuit problems.

Course Content Details:

Unit No	Topics / Sub-topics
1	Single Phase AC Series Circuits <ol style="list-style-type: none"> 1.1 Instantaneous equations for voltage and current of ac quantity 1.2 Vector representation of alternating quantity: <ul style="list-style-type: none"> ➤ Rectangular form ➤ Polar form (Numerical on form conversion) 1.3 A.C through pure resistance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram. 1.4 A.C through pure inductance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram. 1.5 A.C through pure capacitance alone:- Expression of voltage, current and power, waveforms of v, i & p, phasor diagram.

	<p>1.6 Waveforms, phasor diagram and expression of voltage, current and power, impedance triangle, nature of power factor in R-L, R-C, R-L-C series circuits (Numerical)</p> <p>1.7 Power triangle:-active power, reactive power and apparent power.</p> <p>1.8 Resonance in R-L-C series circuit (Numerical)</p> <p>1.9 Graphical Representation of Resonance, resonance curve, Quality (Q) Factor of series resonant circuit.</p> <p>Course Outcome: EE19 208.1 Teaching Hours :16 Marks: 18 (R-04 , U-04 , A-10)</p>
2	<p>Single phase Parallel circuits</p> <p>2.1 Concept of susceptance, admittance and conductance</p> <p>2.2 Solving AC parallel circuit by vector or phasor method, Admittance method and vector algebra. (Numerical on above)</p> <p>2.3 Series equivalent of parallel circuit.</p> <p>2.4 Parallel equivalent of series circuit</p> <p>2.5 Parallel Resonance, Q-factor (Numerical).</p> <p>2.6 Graphical representation of parallel resonance.</p> <p>2.7 Comparison of series and parallel resonance</p> <p>Course Outcome: EE19 208.2 Teaching Hours :12 Marks: 12 (R- 04 , U- 04 , A-04)</p>
3	<p>Polyphase circuits</p> <p>3.1 Principle of generation of 3 –ϕ alternating emf.</p> <p>3.2 Advantages of Polyphase circuit over single phase circuit.</p> <p>3.3 Phase Sequence.</p> <p>3.4 Types of three phase connections-Star connection and delta connection.</p> <p>3.5 Concept of balanced and unbalanced load</p> <p>3.6 Relation between phase and line quantities of star connection.</p> <p>3.7 Relation between phase and line quantities of delta connection. (Numerical on balanced load only)</p> <p>Course Outcome: EE19 208.3 Teaching Hours :10 Marks: 10 (R- 04 , U- 02, A-04)</p>
4	<p>Network Analysis-Techniques (DC Circuits) and Theorems</p> <p>4.1 Mesh analysis</p> <p>4.2 Nodal analysis using voltage and current sources</p> <p>4.3 Superposition Theorem.</p> <p>4.4 Thevenin's Theorem.</p> <p>4.5 Norton's Theorem.</p> <p>4.6 Maximum power transfer Theorem.</p> <p>4.7 Reciprocity theorem.</p> <p>4.8 Introduction to AC Network (How to solve only) (4.1 to 4.7 numerical on DC Circuits only)</p> <p>Course Outcome: EE19 208.4 Teaching Hours :22 Marks: 20 (R- 02 , U-04 , A- 014)</p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Single Phase AC Series Circuit	04	04	10	18
2	Single phase Parallel circuit	04	04	04	12
3	Polyphase circuit	04	02	04	10
4	Network Theorems	02	04	14	20
Total		14	14	32	60

List of experiments: Total 10 experiments (or turns) out of 15-16 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	EE19 208.1	To carry out analysis of given RLC series circuit	02
2	2	EE19 208.2	To find out the current flowing through each component in RC parallel circuit	02
3	3	EE19 208.3	To carry out Three Phase Power Measurement	02
4	4	EE19 208.4	Verification of Reciprocity Theorem	04
5	4	EE19 208.4	Verification of Superposition Theorem	04
6	4	EE19 208.4	Verification of Thevenin's Theorem	02
7	4	EE19 208.4	Verification of Maximum Power Transfer Theorem	04
8	4	EE19 208.4	Verification of Norton's Theorem	04
9	2	EE19 208.2	To find out the current flowing through each component in LC parallel circuit	02
10	2	EE19 208.2	To find out the current flowing through each component in parallel RLC circuit	02
Total				30

Note: Experiments No. 1 to 4 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

Tutorial/Assignment:

Sr. No.	Unit No	COs	Title of tutorial/assignment	Hours
1	1	EE19 208.1	Numerical on form conversion	02
2	1	EE19 208.1	Solve RL, RC and RLC series circuit	04

3	1	EE19 208.1	Solve problems on resonance in RLC series circuit	02
4	2	EE19 208.2	Solve AC parallel circuit by vector or phasor method, admittance method and vector algebra	04
5	2	EE19 208.2	Solve problems on Parallel Resonance and Q-factor	04
6	3	EE19 208.3	Solve problems on balanced three phase star and delta connection	04
7	4	EE19 208.4	Solve the problems on superposition theorem	04
8	4	EE19 208.4	Solve the problems on Thevenin's and Norton's Theorem	04
9	4	EE19 208.4	Solve the problems on Maximum Power transfer theorem and Reciprocity theorem	02
Total				30

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	A Textbook of Electrical Technology - Volume I	B L Theraja , S Chand; Twenty Third edition (1 January 1959)	ISBN-10: 8121924405 ISBN-13: 978-8121924405
2	Electric Circuits	David A. Bell, Oxford University Press; Seventh edition (9 April 2009)	ISBN-10: 9780195694284 ISBN-13: 978-0195694284
3	Schaum's Outline of Electric Circuits, 6th edition (Schaum's Outlines)	Mahmood Nahvi, Joseph Edminister, McGraw Hill Education; 6 edition (16 December 2013)	ISBN-10: 0071830456 ISBN-13: 978-0071830454

E-References:

1. <https://ndl.iitkgp.ac.in/>
2. <https://nptel.ac.in/>
3. <http://vlabs.iitkgp.ac.in/asnm/>
4. <http://amrita.vlab.co.in/?sub=1&brch=75>

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
EE19 208.1	3	3	--	3	2	2	3	2	2	2
EE19 208.2	3	3	--	3	2	2	3	3	3	3
EE19 208.3	3	3	--	3	2	2	3	3	3	3
EE19 208.4	3	3	--	3	2	2	3	2	1	1

Industry Consultation Committee:

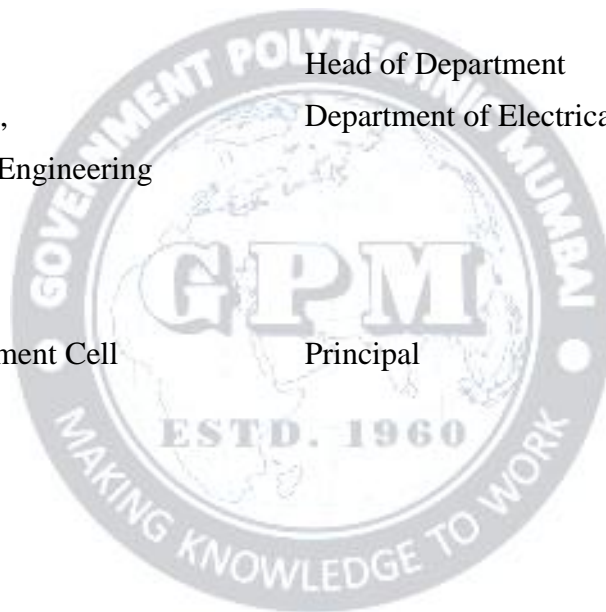
Sr. No	Name	Designation	Institute/Organisation
1	Mrs. Asmita S Marathe	Additional Executive Engineer	MSEDL, Thane
2	Mr. Vijay F Badguajr	Dy. Manager (Maintenance)	Graphite Vcarb India Ltd, Nasik
3	Mrs. R U Patil	LEE	VPM Polytechnic, Thane
4	Mrs. Rajitha TB	LEE	Bharti Vidyapeeth, Navi Mumbai
5	Miss .A.V. Patil	LEE	Govt. Polytechnic Mumbai
6	Dr. Mahesh S. Narkhede	LEE	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Electrical Engineering

Head of Department
Department of Electrical Engineering

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Electrical Engineering.										
Course Code: EE 19 209				Course Title: DC Machines & Transformer						
Compulsory / Optional: C										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2.30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
04	02	--	06	60	20	20	50*	--	25	175

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal assessment , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term

Rationale:

This is the subject intends to teach facts , concepts, principle and procedure for operation and testing of electrical machine, such as d. c. generators, d. c. motors and single & three phase transformers. Students will be able to analyze the characteristics of d.c. Machines, transformer and qualitative parameters of these machines.

These machines are used in transmission, distribution & utilization systems. Knowledge gained by the students will be helpful in the study of technological subjects such as utilization of electrical energy, switchgear & protection, testing, maintenance of electrical machines.

The knowledge & the skills obtained will be helpful in discharging duties such as supervisor, controller & R & D technician.

Course Outcomes: Student should be able to

EE19 209.1	Explain concept of Electromechanical Energy Conversion & different types of DC generators.
EE19 209.2	Maintain different types of DC motors.
EE19 209.3	Interprets single phase transformer.
EE19 209.4	Comprehend three phase transformers.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Topic Title: Introduction to D.C. Machines.</p> <p>1.1 Principles of Electromechanical Energy Conversion.</p> <p>1.2 Necessity of DC Machines.</p> <p>1.3 Constructional parts of D.C. machines- Material used and their functions.</p> <p>1.4 Armature windings: Types and comparison. (No numerical)</p> <p>Course Outcome: EE19 209.1,EE19 209.2 Teaching Hours : 06 hrs Marks: 04 (R-02, U-02, A-)</p>
2	<p>Topic Title: D.C. Generators</p> <p>2.1 Working principle of D,C. Generator, Fleming's right hand rule.</p> <p>2.2 Types of D.C. Generators.</p> <p>2.3 E.M.F equation & voltage equation of all types of D.C. Generators.</p> <p>2.4 Losses in D.C. Generator.</p> <p>2.5 Power stages of D.C. Generator.</p> <p>2.6 Characteristics of D.C. Generators.</p> <p>2.7 Armature reaction.</p> <p>2.8 Commutation, methods to improve commutation.</p> <p>2.9 Applications of all generators. (simple numerical on above)</p> <p>Course Outcome: EE19 209.1 Teaching Hours : 12 hrs Marks:12 (R- 02, U-06, A-04)</p>
3	<p>Topic Title: D.C. Motors</p> <p>3.1 DC motor: Working principle, Fleming's left hand rule, Types of DC motors.</p> <p>3.2 Back e.m.f. and its significance, Voltage equation of DC motor.</p> <p>3.3 Torque and Speed; Armature torque, Shaft torque,</p> <p>3.4 DC motor starters: Necessity and working of three point starters.</p>

	<p>3.5 Speed control of DC shunt and series motor: Flux and Armature control.</p> <p>3.6 losses, efficiency and applications.(simple numerical on above)</p> <p>3.7 Brushless DC Motor: Construction, working advantages and disadvantages and applications.</p> <p>Course Outcome: EE19 209.2 Teaching Hours :12 Marks: 12 (R-02, U-04, A-06)</p>
4	<p>Topic Title: Single Phase Transformers</p> <p>4.1 Transformer: Principle of operation</p> <p>4.2 Types of transformers: Shell type and core type.</p> <p>4.3 Construction: Parts and functions, materials used for different parts: CRGO, CRNGO, HRGO, amorphous cores,</p> <p>4.4 EMF equation of transformer: Derivation, Voltage transformation ratio.</p> <p>4.5 Concept of ideal transformer.</p> <p>4.6 Transformer on No-load and on-load phasor diagram.</p> <p>4.7 Magnetic leakage.</p> <p>4.8 Equivalent circuit of transformer: Equivalent resistance and reactance.</p> <p>4.9 Voltage regulation and Efficiency: Direct loading, OC/SC method.</p> <p>4.10 kVA rating of transformer.</p> <p>4.11 All day efficiency.</p> <p>4.12 Polarity of transformer</p> <p>(Simple numerical on above)</p> <p>Course Outcome: EE19 209.3 Teaching Hours : 16 Marks: 20 (R-04, U-08, A-08)</p>
5	<p>Topic Title: Three Phase Transformers</p> <p>5.1 Bank of three single phase transformers, Single unit of three phase transformer.</p> <p>5.2 Distribution and Power transformers: Construction and cooling.</p> <p>5.3 Three phase transformers connections as per IS:2026 (part IV)-1977.</p> <p>5.4 Vector groups</p>

<p>5.5 Three phase to two phase conversion (Scott Connection),</p> <p>5.6 Selection of transformer as per IS: 10028 (Part I)-1985.</p> <p>5.7 Criteria for selection of distribution transformer, and power transformer.</p> <p>5.8 Amorphous Core type Distribution Transformer.</p> <p>5.9 Specifications of three-phase distribution transformers as per IS:1180 (part I)-1989.</p> <p>5.10 Need of parallel operation of three phase transformer.</p> <p>5.11 Conditions for parallel operation.</p> <p>Course Outcome: EE19 209.4 Teaching Hours : 14 Marks: 12 (R-04, U-08, A-)</p>
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Suggested Specifications Table (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to D.C. Machines.	06	02	02	--	04
2	D.C. Generators	12	02	06	04	12
3	D.C. Motors	12	02	04	06	12
4	Single Phase Transformers	16	04	08	08	20
5	Three Phase Transformers	14	04	08	--	12
Total		60	14	28	18	60

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. No.	Unit No	COs	Title of the Experiments	Hours
1	-	ALL CO	Write a report on the machine laboratory in terms of practicing of reading name plates of various machines and their supply system.	02
2	1	EE19 209.1,2	To study the constructional parts of D.C. Machine.	04
3	2	EE19 209.1	To plot O.C.C. of D.C. Generator.	02
4	2	EE19 209.1	To plot load characteristic of D.C. Shunt Generator.	02
5	3	EE19 209.2	Speed control of D.C. Shunt motor using Flux control and Armature voltage control methods	04
6	3	EE19 209.2	Load test on D.C. Shunt motor and calculate torque and efficiency.	04
7	4	EE19 209.3	Determine the efficiency and voltage regulation of single phase transformer by direct loading.	04
8	4	EE19 209.3	To perform O.C.& S.C. test on single phase transformer to find efficiency and voltage regulation of transformer.	04
9	5	EE19 209.4	To study the constructional details of distribution and power transformer. (based on a visit to transformer manufacturing or repairing industry)	
10	4	EE19 209.3	Parallel operation of single phase transformer.	04
Total				30

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Electrical Machines, Vol-I, II	G.C. Garg & P.S. Bimbhra, Khanna Book Publishing House, New Delhi.	ISBN: 978-9386173-447, 978-93-86173-607
2	Electrical Technology Vol-II	Theraja B.L., S. Chand and Co. Ltd., New Delhi.	ISBN: 9788121924375

3	Electrical Machines.	Bhattacharya S. K., McGraw Hill Education, New Delhi.	ISBN: 9789332902855
4	Electrical Machines.	Kothari D. P. and Nagrath, I. J., McGraw Hill Education. New Delhi.	ISBN: 9780070699670
5	Principles of Electrical Machines.	Mehta V. K. and Mehta Rohit, . S. Chand and Co. Ltd., New Delhi.	ISBN: 9788121930888
6	Electrical Machines Theory and Practice.	Bandyopadhyay M. N., PHI Learning Pvt. Ltd., New Delhi.	ISBN: 9788120329973 Vi
7	Basic Electrical Engineering.	Mittle V.N. and Mittle Arvind., McGraw Hill Education, New Delhi.	ISBN: 9780070593572

E-References:

1. www.nptel.com
2. www.electrical4u.com
3. www.electrical-energizing-portal.com
4. www.learnerstv.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
EE19 209.1	2	2	1	3	1	1	-	3	2	2
EE19 209.2	3	2	3	3	1	1	3	3	2	2
EE19 209.3	3	2	3	3	1	1	3	3	2	2
EE19 209.4	3	2	3	3	1	1	3	3	2	2
EE19 209.5	3	2	3	3	1	1	3	3	2	2

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
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3	Prof. L.S. Patil	Selection Grade lecturer	Govt. Polytechnic Nasik
4	Name of Faculty: 1. A.K. Dhulshette 2. Dr. P.N.Padghan (Curriculum Content Designer)	Selection Grade lecturer Selection Grade lecturer	Govt. Polytechnic Mumbai

Coordinator,

Curriculum Development,

Department of _____

Head of Department

Department of _____

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Electrical Engineering (Sandwich Pattern)										
Course Code: EE 19 302				Course Title: Electrical Transmission & Distribution						
Compulsory / Optional: C										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hr 30 Min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
4	2	-	6	60	20	20	50*	-	25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

This is the subject where the principles of electrical transmission and distribution systems are studied. The electricity is generated in bulk at remote places and transmitted to long distances and then distributed in cities, villages and to industry. Knowledge of components of electrical transmission and distribution system and their functions is necessary for understanding power system performance. Study of load dispatch and HVDC transmission is also important for working in power sector.

Course Outcomes: Student should be able to

EE 19 302.1	Explain various transmission and distribution systems.
EE 19 302.2	Calculate the performance of transmission & distribution systems.
EE 19 302.3	Compare between HVDC and HVAC systems.
EE 19 302.4	Describe the Substation and the Power factor improvement.

Course Content Details:

Unit No	Topics / Sub-topics
1	Transmission line components and parameters: 1.1 Introduction to line component. 1.2 Types of conductor- Al, Cu, ACSR, AAC, AAAC, ACSR, HTLS conductor and solid stranded bundle conductors. 1.3 Line supports – requirement, type. Construction of supporting structures, Towers, monopoles 1.4 Spacing between conductors. 1.5 Concept of length of span. 1.6 Sag in overhead line. 1.7 Calculations of sag: effect of wind and ice loading (Simple Numerical) 1.8 Types of insulator – Pin, Suspension, Strain, Stay, Shackle. 1.9 Safety factor, puncture and ultimate strength.

	<p>1.10 Potential distribution over a string of suspension insulator.</p> <p>1.11 Simple numerical on string efficiency.</p> <p>1.12 Constants of transmission lines</p> <p>1.13 Skin effect</p> <p>1.14 Transposition of conductor and necessity.</p> <p>1.15 Proximity effect</p> <p>Course Outcome: EE 19 302.1 Teaching Hours : 14 Marks: 12 (R- 4, U- 4, A-4)</p>
2	<p>Performance of transmission line:</p> <p>2.1 Classification of transmission line, Important terms, regulation & efficiency of T/L</p> <p>2.2 Short transmission line, eq. circuit representation & phasor diagram & analysis. (Simple Numerical)</p> <p>2.3 Medium transmission line, End condenser method, Nominal T and π circuit representation & analysis, phasor diagram.</p> <p>2.4 Ferranti effect.</p> <p>2.5 Introduction of Long transmission line.</p> <p>2.6 Corona</p> <ul style="list-style-type: none"> • Factors affecting corona. • Important terms • Advantages and disadvantages of corona. • Methods of reducing corona effect <p>Course Outcome: EE 19 302.1, EE 19 302.2 Teaching Hours : 10 Marks: 12 (R- 4, U- 4, A- 4)</p>
3	<p>EHVAC, HVDC and Load Dispatch Center:</p> <p>3.1 EHVAC transmission system, advantages, disadvantages.</p> <p>3.2 HVDC transmission system, applications, configuration & parts of HVDC system, types of HVDC system, standard rated voltage, present status and growth prospects of HVDC transmission system</p> <p>3.3 Compare between EHVAC & HVDC</p> <p>3.4 National, Regional and State Load Dispatch Centers.</p> <p>3.5 Introduction to grid and different voltage levels for HVAC and HVDC.</p> <p>3.6 Introduction to Line In Line Out system (LILO).</p> <p>Course Outcome: EE 19 302.1, EE 19 302.3 Teaching Hours : 10 Marks: 10 (R- 4, U- 4, A- 2)</p>
4	<p>Distribution system:</p> <p>4.1 Components of Distribution system - distributor, feeder and service mains.</p> <p>4.2 Classification of distribution system.</p> <p>4.3 A.C. distribution.</p> <p>4.4 Connection scheme of distribution system -radial and ring mains system.</p> <p>4.5 Factors to be considered for design considerations.</p> <p>4.6 Voltage drop calculation for feeder fed at one end for single phase and three phase four wire A.C. balanced system.</p>

	Course Outcome: EE 19 302.1, EE 19 302.2 Teaching Hours : 12 Marks:12 (R- 4, U- 4, A- 4)
5	Underground Cables: 5.1 Introduction and requirement. 5.2 Classification of Cable. 5.3 Cable conductor. 5.4 Cable construction. 5.5 Cable insulation, metallic sheathing and mechanical protection. 5.6 Comparison with overhead lines. 5.7 Methods of cable laying. Course Outcome: EE 19 302.1 Teaching Hours : 06 Marks: 06 (R- 4, U- 2, A- 0)
6	Substation & Power factor improvement: 6.1 Introduction, classification of substations according to service & location. 6.2 Typical single line connection diagrams of substation layouts, 11 KV/0.415KV pole mounted distribution substation, 33KV/11KV substation, 132 KV or 220 KV substations. 6.3 Substation equipments and auxiliary systems, their functions, types (AIS, GIS, Hybrid) and substation earthing. 6.5 Causes and disadvantages of low power factor 6.6 P.F. improvement using static capacitor. 6.7 Advantage of P.F. improvement. Course Outcome: EE 19 302.4 Teaching Hours : 08 Marks: 08 (R- 4, U- 4, A- 0)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Transmission line components and parameters	4	4	4	12
2	Performance of transmission line	4	4	4	12
3	EHVAC , HVDC and Load Dispatch Center	4	4	2	10
4	Distribution system	4	4	4	12
5	Underground Cables	4	2	0	06
6	Substation & Power factor improvement	4	4	0	08
Total		24	22	14	60

List of experiments: Total 10-12 experiments (or turns) out of 15-16 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
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1	1	EE19 302.1	Identify different types of transmission and distribution line supports. Prepare report.	2
2	2	EE19 302.2	Assignment on string efficiency and sag.	2
3	3	EE19 302.3	Compare between HVDC and HVAC systems.	2
4	4	EE19 302.4	Identify different components of 11KV/0.415KV pole mounted distribution substation. Prepare report and draw sheet.	4
5	1	EE19 302.1	Identify different types of transmission line conductors. Prepare report.	2
6	1	EE19 302.1	Identify different types of overhead line insulators. Prepare report.	2
7	2	EE19 302.2	Assignment on transmission efficiency.	2
8	3	EE19 302.1	Identify different components of HVDC terminal substation. Prepare report.	2
9	3	EE19 302.1	Visit to Load Dispatch Centre and Prepare report.	4
10	4	EE19 302.1	Prepare report on various method of 3- Ph, 3- wire AC and 3- Ph, 4- wire AC Distribution system.	2
11	4	EE19 302.2	Assignment on voltage drops in the distributor.	2
12	4	EE19 302.1	Prepare report on various voltage control methods used in the power system.	2
13	5	EE19 302.1	Identify different types of underground cables. Prepare report.	2
14	6	EE19 302.4	Prepare report on various methods of improvement of power factor in A.C. System.	2
15	6	EE19 302.4	Identify different components of 132 or 220 or 400 KV outdoor substation. Prepare report and draw sheet.	4
Total				36

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Elements of Power System	V. K. Mehta and Rohit Mehta, S. Chand and Co. Ltd.	ISBN-10: 9788121924962 ISBN-13: 978-8121924962
2	Transmission & Distribution	J. B. Gupta , S. K. Khanna	ISBN-13: 978-9350143629 ISBN-10: 8185749574
3	Electrical Power System	Dr. S. L. Uppal ,Prof. S. Rao , Khanna Publisher, New Delhi.	ISBN-10: 8174092382 ISBN-13: 978-8174092380
4	A course in Electrical Power	Soni, Gupta, Bhatnagar , Dhanpat Rai & Sons	ISBN-10: 8177000209 ISBN-13: 978-8177000207
5	A course in Power plant Engineering	Dr. V. M. Domkundwar, Dhanpat Rai & Sons	ISBN-10: 8177001957 ISBN-13: 978-8177001952

6	Electrical Power system Design	M.V.Deshpande , Tata McGraw-Hill	ISBN-10: 9780074515754 ISBN-13: 978-0074515754
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E-References:

1. <https://ndl.iitkgp.ac.in/>
2. <https://www.electrical4u.com/electrical-engineering-articles/transmission,distribution,substation,cables/>
3. <https://nptel.ac.in> (Prof.D.P.Kothari)
4. <https://swayam.gov.in>
5. www.khanacademy.org
6. www.youtube.com

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
EE 19 302.1	3	2	-	2	2	3	3	3	2	3
EE 19 302.2	3	2	3	-	-	-	-	1	-	1
EE 19 302.3	1	1	-	-	2	-	3	3	2	3
EE 19 302.4	3	1	-	1	2	3	3	3	2	3

Industry Consultation Committee:

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Programme: Diploma in Electrical Engineering (Sandwich Pattern)

Semester-III

EE 19 303 Linux (17)

1. Ubuntu Desktop 16.04

Outline: Ubuntu Linux Desktop 16.04 Ubuntu Linux Desktop on gnome environment The launcher Some of the icons visible on Launcher Calculator, gedit Text Editor, Terminal, Firefox .

2. Desktop Customization 16.04

Outline: Desktop Customization 16.04 The Launcher Remove applications from the Launcher Add applications to the Launcher System Settings Appearance settings Workspace switcher Use.

3. Installing Software 16.04

Outline: Installing software in Ubuntu Linux 16.04 OS Install software via Terminal Installing Synaptic Package Manager Install software via Synaptic Package Manager Configure proxy .

4. Basic Commands

Outline: Basic Commands Commands with example Command interpreter Shell Using man Apropos What is Using --help option.

5. General Purpose Utilities in Linux

Outline: General Purpose Utilities in Linux echo uname who passwd date cal Brief overview on Files and directories pwd ls cat.

6. File System

Outline: File System File Directory File Inode Types of Files Home directory and Current directory Change Directory(cd) mkdir,rmdir

7. Working with regular Files

Outline: Working with Regular Files cat rm cp mv cmp wc.

8. File Attributes

Outline: File Attributes chown, chmod, chmod -R, displaying files with ls -l chmod u+, chmod a-w, chmod g+w, chmod -r, chgrp inode, hard link, symbolic link.

9. Redirection Pipes

Outline: Redirection Pipes Input,output and error stream Redirection : > and >> Pipes : |.

10. Working with Linux Process

Outline: Working with Linux Process Process Shell process Process spawning - parent and child process Process attributes - pid, ppid Init Process User proces.

11. The Linux Environment

Outline: The Linux Environment Environment variable vs Local variables set command env command SHELL, HOME, PATH, LOGNAME, PS1, PS2 history ! and ~ ali.

12. Basics of System Administration

Outline: Basics of System Administration Root login-su User management - UID, GID, useradd, usermod, userdel Discs – Du, df.

13. Simple Filters

Outline: Simple filters Head tail sort cut paste.

14. The grep command

Outline: The grep command To see the content of a file To list the entries of a particular stream To ignore cases Lines that do not match the pattern To list .

15. More on grep command

Outline: More on grep command Search using grep To match more than one pattern To check a word that has different spelling Character class The use of * T.

16. The sed command

Outline: The sed command sed To print using sed Line Addressing Context Addressing.

17. More on sed command

Outline: Some more on sed command substitute insert delete