GOVERNMENT POLYTECHNIC PUNE

University Road, Pune 411 016

Detailed Path Structure of Path GS1

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequ isites	Teaching Fields				Exam Fields							Section
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	
LEVEL - I Foundation level courses														
(All Compulsory)														
HU181	ENGLISH	-	2	2	0	4	20	80	25	0	0	125	—	-
HU182	COMMUNICATION SKILLS	-	2	2	0	4	20	80	0	25	0	125	—	-
SC181	APPLIED MATHEMATICS - I	-	3	0	1	4	20	80	0	0	0	100	—	-
SC182	APPLIED MATHEMATICS - II	-	3	0	1	4	20	80	0	0	0	100	—	-
SC183	ENGINEERING PHYSICS	-	3	2	0	5	20	80	0	0	50	150	—	-
SC184	ENGINEERING CHEMISTRY	-	3	2	0	5	20	80	0	0	50	150	—	-
		Total:	16	8	2	26	120	480	25	25	100	750		
LEVEL - II Basic Technology Courses														
(All Compulsory)														
AM286	ENGINEERING MECHANICS	-	4	2	0	6	20	80	25	0	0	125	—	-
CM286	COMPUTER FUNDAMENTALS	-	1	2	0	3	0	0	25	0	50	75	—	-
CM287	C PROGRAMMING	-	2	2	0	4	0	0	0	0	50	50	—	-
EE281	BASIC ELECTRICAL ENGINEERING	-	3	2	1	6	20	80	0	0	50	150	—	-
ET281	BASIC ELECTRONICS	-	4	2	0	6	20	80	25	0	50	175	—	-
ME284	ENGINEERING DRAWING	-	2	2	0	4	0	0	50	0	0	50	—	-
ME285	FUNDAMENTALS OF MECHANICAL	-	2	2	0	4	0	0	0	50	0	50	—	-
WS281	WORKSHOP PRACTICE	-	0	4	0	4	0	0	50	0	0	50	—	-
		Sub Total:	18	18	1	37	60	240	175	50	200	725		
(Any One)														
HU281	INDUSTRIAL PSYCHOLOGY	-	2	0	1	3	20	80	0	0	0	100	—	-
SC282	ENGINEERING MATHEMATICS	-	2	0	1	3	20	80	0	0	0	100	—	-
		Sub Total:	2	0	1	3	20	80	0	0	0	100		
		Total:	20	18	2	40	80	320	175	50	200	825		

LEVEL - III BASIC TECHNOLOGY COURSES

Core

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC PUNE

University Road, Pune 411 016

Detailed Path Structure of Path GS1

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequisites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
			(All Compulsory)											
EE381	MINI PROJECT	-	0	2	0	2	0	0	25	25	0	50	—	-
EE382	ELECTRICAL CIRCUITS AND NETWORKS	-	3	2	1	6	20	80	0	0	50	150	—	-
EE383	ELECTRICAL MEASUREMENTS	-	3	2	0	5	20	80	0	0	50	150	—	-
EE384	ELECTRICAL POWER GENERATION	-	3	1	0	4	20	80	0	25	0	125	—	-
EE385	ELECTRICAL MATERIALS AND WORKSHOP	-	1	2	0	3	0	0	50	0	0	50	—	-
EE386	COMPUTER AIDED ELECTRICAL DRAWING	-	0	2	0	2	0	0	0	0	50	50	—	-
EE387	ELECTRICAL MACHINES - I	EE281	3	2	1	6	20	80	0	0	50	150	—	-
EE388	TRANSMISSION AND DISTRIBUTION OF	-	3	2	0	5	20	80	0	25	0	125	—	-
EE389	INSTRUMENTATION AND CONTROL	-	3	2	0	5	20	80	0	25	0	125	—	-
ET390	DIGITAL ELECTRONICS AND MICROPROCESSOR	ET281	3	2	0	5	20	80	0	0	50	150	—	-
		Total:	22	19	2	43	140	560	75	100	250	1125		
	LEVEL - IV APPLIED TECHNOLOGY COURSES													
			(Any Two)											
AU481	ENVIRONMENTAL SCIENCE@	-	0	2	0	2	0	0	50	0	0	50	—	-
AU482	COMMUNITY DEVELOPMENT	-	2	0	0	2	20	80	0	0	0	100	—	-
AU483	RENEWABLE AND SUSTAINABLE ENERGY	-	2	0	0	2	20	80	0	0	0	100	—	-
AU484	ENGINEERING ECONOMICS	-	2	0	0	2	20	80	0	0	0	100	—	-
		Sub Total:	2	2	0	4	20	80	50	0	0	150		
			(Any One)											
MA481	CONSTRUCTION MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA482	INDUSTRIAL ORGANISATION AND	-	3	0	0	3	20	80	0	0	0	100	—	-

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Detailed Path Structure of Path GS1

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequ isites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
MA483	ENTREPRENEURSHIP DEVELOPMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA484	MATERIALS MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA485	SUPERVISORY MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA486	TOTAL QUALITY MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA487	MANAGEMENT INFORMATION SYSTEM	-	3	0	0	3	20	80	0	0	0	100	—	-
		Sub Total:	3	0	0	3	20	80	0	0	0	100		
		(All Compulsory)												
EE481	PROJECT AND SEMINAR (INHOUSE / INDUSTRY	90 CR	0	8	0	8	50	0	50	50	0	150	YES	-
EE482	POWER ELECTRONICS AND DRIVES	ET281	3	2	0	5	20	80	0	25	0	125	YES	YES
EE483	A.C. MACHINES	EE387	3	2	1	6	20	80	0	0	50	150	YES	YES
EE484	TESTING AND MAINTENANCE OF E.E.	EE483	4	2	0	6	20	80	0	25	0	125	YES	YES
EE485	SWITCHGEAR AND PROTECTION	-	4	2	0	6	20	80	0	25	0	125	YES	YES
EE486	ELECTRICAL ESTIMATION AND COSTING	EE385	2	2	1	5	20	80	0	25	0	125	YES	YES
EE487	UTILISATION OF ELECTRICAL ENERGY	-	3	2	0	5	20	80	0	25	0	125	YES	YES
EE488	ENERGY AUDIT AND CONSERVATION	EE383	3	2	0	5	20	80	0	25	0	125	YES	YES
		Sub Total:	22	22	2	46	190	560	50	200	50	1050		
		(All Compulsory)												
NC481	DEVELOPMENT OF SOFT SKILLS - I	-	0	2	0	2	0	0	25	0	0	25	—	-
NC482	DEVELOPMENT OF SOFT SKILLS - II	-	0	2	0	2	0	0	25	0	0	25	—	-
		Sub Total:	0	4	0	0	0	0	50	0	0	50		
		Total:	27	28	2	53	230	720	150	200	50	1350		

LEVEL -V DIVERSIFIED COURSES

(Any Three)

Detailed Path Structure of Path GS1

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequ isites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
EE581	INDUSTRIAL AUTOMATION	EE483	4	2	0	6	20	80	0	0	50	150	YES	YES
EE582	INDUSTRIAL CONTROL AND CONTROL PANEL	EE483	4	2	0	6	20	80	0	50	0	150	YES	YES
EE583	ELECTRICAL MACHINE DESIGN	EE483	4	2	0	6	20	80	0	50	0	150	YES	YES
EE584	MICROCONTROLLER AND APPLICATIONS	ET390	4	2	0	6	20	80	0	0	50	150	YES	YES
EE585	ILLUMINATION ENGINEERING	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
EE586	ELECTRICAL BUILDING MAINTENANCE SYSTEM	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
EE587	MODERN ELECTRIC TRACTION	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
		Total:	12	6	0	18	60	240	0	100	50	450		
		Grand Total:	97	79	8	180	630	2320	425	475	650	4500		

The Ratio of Theory to Practical is 52:48

Abbreviations: L:Lecture Credits; P:Practical Credits; C:Total Credits; PA:Progressive Assessment(Test) Marks; TH:Theory Marks; PR:Practical Marks; TW.:Term Work Marks; OR:Oral Marks; Tot:Total Marks; @:Compulsory

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC PUNE

University Road, Pune 411 016

Detailed Path Structure of Path GS2

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequ isites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
LEVEL - I Foundation level courses														
(All Compulsory)														
HU181	ENGLISH	-	2	2	0	4	20	80	25	0	0	125	—	-
HU182	COMMUNICATION SKILLS	-	2	2	0	4	20	80	0	25	0	125	—	-
SC181	APPLIED MATHEMATICS - I	-	3	0	1	4	20	80	0	0	0	100	—	-
SC182	APPLIED MATHEMATICS - II	-	3	0	1	4	20	80	0	0	0	100	—	-
SC183	ENGINEERING PHYSICS	-	3	2	0	5	20	80	0	0	50	150	—	-
SC184	ENGINEERING CHEMISTRY	-	3	2	0	5	20	80	0	0	50	150	—	-
		Total:	16	8	2	26	120	480	25	25	100	750		
LEVEL - II Core Technology Courses														
(All Compulsory)														
AM281	ENGINEERING MECHANICS	-	4	2	0	6	20	80	25	0	0	125	—	-
CM286	COMPUTER FUNDAMENTALS	-	1	2	0	3	0	0	25	0	50	75	—	-
CM287	C PROGRAMMING	-	2	2	0	4	0	0	0	0	50	50	—	-
EE281	BASIC ELECTRICAL ENGINEERING	-	3	2	1	6	20	80	0	0	50	150	—	-
ET281	BASIC ELECTRONICS	-	4	2	0	6	20	80	25	0	50	175	—	-
ME284	ENGINEERING DRAWING	-	2	2	0	4	0	0	50	0	0	50	—	-
ME287	FUNDAMENTALS OF MECHANICAL	-	2	2	0	4	20	80	0	0	0	100	—	-
WS281	WORKSHOP PRACTICE	-	0	4	0	4	0	0	50	0	0	50	—	-
		Sub Total:	18	18	1	37	80	320	175	0	200	775		
(Any One)														
HU281	INDUSTRIAL PSYCHOLOGY	-	2	0	1	3	20	80	0	0	0	100	—	-
SC282	ENGINEERING MATHEMATICS	-	2	0	1	3	20	80	0	0	0	100	—	-
		Sub Total:	2	0	1	3	20	80	0	0	0	100		
		Total:	20	18	2	40	100	400	175	0	200	875		

LEVEL - III BASIC TECHNOLOGY COURSES

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Detailed Path Stucuire of Path GS2

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequisites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
							(All Compulsory)							
EE381	MINI PROJECT	-	0	2	0	2	0	0	25	25	0	50	—	-
EE382	ELECTRICAL CIRCUITS AND NETWORKS	-	3	2	1	6	20	80	0	0	50	150	—	-
EE383	ELECTRICAL MEASUREMENTS	-	3	2	0	5	20	80	0	0	50	150	—	-
EE384	ELECTRICAL POWER GENERATION	-	3	1	0	4	20	80	0	25	0	125	—	-
EE386	COMPUTER AIDED ELECTRICAL DRAWING	-	0	2	0	2	0	0	0	0	50	50	—	-
EE387	ELECTRICAL MACHINES - I	EE281	3	2	1	6	20	80	0	0	50	150	—	-
EE388	TRANSMISSION AND DISTRIBUTION OF	-	3	2	0	5	20	80	0	25	0	125	—	-
EE389	INSTRUMENTATION AND CONTROL	-	3	2	0	5	20	80	0	25	0	125	—	-
EE390	ELECTRICAL MATERIALS AND WORKSHOP	-	1	2	0	3	10	40	25	25	0	100	—	-
ET390	DIGITAL ELECTRONICS AND MICROPROCESSOR	ET281	3	2	0	5	20	80	0	0	50	150	—	-
		Total:	22	19	2	43	150	600	50	125	250	1175		
			LEVEL - IV APPLIED TECHNOLOGY COURSES											
			(Any Two)											
AU481	ENVIRONMENTAL SCIENCE@	-	0	2	0	2	0	0	50	0	0	50	—	-
AU482	COMMUNITY DEVELOPMENT	-	2	0	0	2	20	80	0	0	0	100	—	-
AU483	RENEWABLE AND SUSTAINABLE ENERGY	-	2	0	0	2	20	80	0	0	0	100	—	-
AU484	ENGINEERING ECONOMICS	-	2	0	0	2	20	80	0	0	0	100	—	-
		Sub Total:	2	2	0	4	20	80	50	0	0	150		
			(Any One)											
MA481	CONSTRUCTION MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA482	INDUSTRIAL ORGANISATION AND	-	3	0	0	3	20	80	0	0	0	100	—	-

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC PUNE

University Road, Pune 411 016

Detailed Path Structure of Path GS2.

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequisites	Teaching Fields				Exam Fields							
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL	Class Declared	Section
MA483	ENTREPRENEURSHIP DEVELOPMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA484	MATERIALS MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA485	SUPERVISORY MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA486	TOTAL QUALITY MANAGEMENT	-	3	0	0	3	20	80	0	0	0	100	—	-
MA487	MANAGEMENT INFORMATION SYSTEM	-	3	0	0	3	20	80	0	0	0	100	—	-
		Sub Total:	3	0	0	3	20	80	0	0	0	100		
		(All Compulsory)												
EE481	PROJECT AND SEMINAR (INHOUSE / INDUSTRY	90 CR	0	8	0	8	50	0	50	50	0	150	YES	-
EE482	POWER ELECTRONICS AND DRIVES	ET281	3	2	0	5	20	80	0	25	0	125	YES	YES
EE483	A.C. MACHINES	EE387	3	2	1	6	20	80	0	0	50	150	YES	YES
EE484	TESTING AND MAINTENANCE OF	EE483	4	2	0	6	20	80	0	25	0	125	YES	YES
EE485	SWITCHGEAR AND PROTECTION	-	4	2	0	6	20	80	0	25	0	125	YES	YES
EE486	ELECTRICAL ESTIMATION AND COSTING	EE385	2	2	1	5	20	80	0	25	0	125	YES	YES
EE487	UTILISATION OF ELECTRICAL ENERGY	-	3	2	0	5	20	80	0	25	0	125	YES	YES
EE488	ENERGY AUDIT AND CONSERVATION	EE383	3	2	0	5	20	80	0	25	0	125	YES	YES
		Sub Total:	22	22	2	46	190	560	50	200	50	1050		
		(All Compulsory)												
NC481	DEVELOPMENT OF SOFT SKILLS - I	-	0	2	0	2	0	0	25	0	0	25	—	-
NC482	DEVELOPMENT OF SOFT SKILLS - II	-	0	2	0	2	0	0	25	0	0	25	—	-
		Sub Total:	0	4	0	0	0	0	50	0	0	50		
		Total:	27	28	2	53	230	720	150	200	50	1350		

LEVEL -V DIVERSIFIED COURSES

(Any Three)

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC PUNE

University Road, Pune 411 016

Detailed Path Structure of Path GS2

Department: DIPLOMA - ELECTRICAL ENGINEERING

Course Code	Courese Title	Prerequisites	Teaching Fields				Exam Fields						Class Declared	Section
			L	P	T	C	PA	TH	TW	OR	PR	TOTAL		
EE581	INDUSTRIAL AUTOMATION	EE483	4	2	0	6	20	80	0	0	50	150	YES	YES
EE582	INDUSTRIAL CONTROL AND CONTROL PANEL	EE483	4	2	0	6	20	80	0	50	0	150	YES	YES
EE583	ELECTRICAL MACHINE DESIGN	EE483	4	2	0	6	20	80	0	50	0	150	YES	YES
EE584	MICROCONTROLLER AND APPLICATIONS	ET390	4	2	0	6	20	80	0	0	50	150	YES	YES
EE585	ILLUMINATION ENGINEERING	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
EE586	ELECTRICAL BUILDING MAINTENANCE SYSTEM	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
EE587	MODERN ELECTRIC TRACTION	EE487	4	2	0	6	20	80	0	50	0	150	YES	YES
		Total:	12	6	0	18	60	240	0	100	50	450		
		Grand Total:	97	79	8	180	660	2440	400	450	650	4600		

The Ratio of Theory to Practical is 52:48

Abbreviations: L:Lecture Credits; P:Practical Credits; C:Total Credits; PA:Progressive Assessment(Test) Marks; TH:Theory Marks; PR:Practical Marks; TW:Term Work Marks; OR:Oral Marks; Tot:Total Marks; @:Compulsory

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Summary of Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Total Credits		180
Total No. Courses		39
No.of Courses with Theory Examination		28
No.of Courses with Practical Examination		33
No.of Courses without Theory Examination		11
Total Marks		4425
Marks for Class Declaration		1500
Theory Paper Marks for Class Declaration		1000
Theory : Practical Ratio		53:47
Class Declaration Courses		11
Non Credit Courses		2

Level	Credits
I	26
II - A	37
II - B	3
III	45
IV - A	4
IV - B	3
IV - C	44
IV - D	--
V	18
Total	180

(Shri S. V. Chaudhari)
CDC In-charge

(Shri C. Y. Totewar)
Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Level - II Core Technology Courses

GROUP - A (All Compulsory)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
AM281	Engineering Mechanics	--	Compulsory	4	2	--	6	20	80	25	--	--	125	--
CM286	Computer Fundamentals	--	Compulsory	1	2	--	3	--	--	25	--	50	75	--
CM287	C Programming	--	Compulsory	2	2	--	4	--	--	--	--	50	50	--
EE281	Basic Electrical Engineering	--	Compulsory	3	2	1	6	20	80	--	--	50	150	--
ET281	Basic Electronics	--	Compulsory	4	2	--	6	20	80	25	--	50	175	--
ME284	Engineering Drawing	--	Compulsory	2	2	--	4	--	--	50	--	--	50	--
ME285	Fundamentals of Mechanical Engineering	--	Compulsory	2	2	--	4	--	--	--	50	--	50	--
WS281	Workshop Practice	--	Compulsory	--	4	--	4	--	--	50	--	--	50	--
			Total	**18**	**18**	**1**	**37**	**60**	**240**	**175**	**50**	**200**	**725**	--

GROUP - B (Any One)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
HU281	Industrial Psychology	--	Optional	2	--	1	3	20	80	--	--	--	100	--
SC282	Engineering Mathematics	--	Optional	2	--	1	3	20	80	--	--	--	100	--
			Total	**2**	**0**	**1**	**3**	**20**	**80**	**0**	**0**	**0**	**100**	--

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Level I - Foundation Level Courses (All Compulsory)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
HU181	English	--	Compulsory	2	2	--	4	20	80	25	--	--	125	--
HU182	Communication Skills	--	Compulsory	2	2	--	4	20	80	--	25	--	125	--
SC181	Applied Mathematics - I	--	Compulsory	3	--	1	4	20	80	--	--	--	100	--
SC182	Applied Mathematics - II	--	Compulsory	3	--	1	4	20	80	--	--	--	100	--
SC183	Engineering Physics	--	Compulsory	3	2	--	5	20	80	--	--	50	150	--
SC184	Engineering Chemistry	--	Compulsory	3	2	--	5	20	80	--	--	50	150	--
			Total	**16**	**8**	**2**	**26**	**120**	**480**	**25**	**25**	**100**	**750**	--

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Level III – Basic Technology Courses (All Compulsory)														
Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
EE381	Mini Project	--	Compulsory	--	2	--	2	--	--	25	25	--	50	--
EE382	Electrical Circuits and Networks	--	Compulsory	3	2	1	6	20	80	--	--	50	150	--
EE383	Electrical Measurements	--	Compulsory	3	2	--	5	20	80	--	--	50	150	--
EE384	Electrical Power Generation	--	Compulsory	3	2	--	5	20	80	--	50		150	--
EE385	Electrical Materials and Workshop	--	Compulsory	1	2	--	3	--	--	50	--	--	50	--
EE386	Computer Aided Electrical Drawing and Simulation	--	Compulsory	1	2	--	3	--	--	--	--	50	50	--
EE387	Electrical Machine - I	EE281	Compulsory	3	2	1	6	20	80	--	--	50	150	--
EE388	Electrical Machine - II	EE387	Compulsory	3	2	1	6	20	80	--	--	50	150	--
EE389	Control Panel Design	--	Compulsory	2	2	--	4	--	--	--	50	--	50	--
ET390	Digital Electronics and Microprocessor	ET281	Compulsory	3	2	--	5	20	80	--	--	50	150	--
			Total	**22**	**20**	**3**	**45**	**120**	**480**	**75**	**125**	**300**	**1100**	**--**

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Level - IV Applied Technology Courses														
GROUP - A (Any Two)														
Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
AU481	Environmental Science@	--	Compulsory	--	2	--	2	--	--	50	--	--	50	--
AU482	Community Development	--	Optional	2	--	--	2	20	80	--	--	--	100	--
AU483	Renewable & Sustainable Energy	--	Optional	2	--	--	2	20	80	--	--	--	100	--
AU484	Engineering Economics	--	Optional	2	--	--	2	20	80	--	--	--	100	--
			Total	**2**	**2**	**0**	**4**	**20**	**80**	**50**	**0**	**0**	**150**	--

GROUP - B (Any One)														
Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
MA481	Construction Management	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA482	Industrial Organisation and Management	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA483	Entrepreneurship Development	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA484	Materials Management	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA485	Supervisory Management	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA486	Total Quality Management	--	Optional	3	--	--	3	20	80	--	--	--	100	--
MA487	Management Information System	--	Optional	3	--	--	3	20	80	--	--	--	100	--
			Total	**3**	**0**	**0**	**3**	**20**	**80**	**0**	**0**	**0**	**100**	--

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

GROUP - C (All Compulsory)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
EE481	Project and Seminar (In-house / Industry)	90 Credits	Compulsory	--	8	--	8	50	--	50	50	--	150	150
EE482	Transmission and Distribution of Electrical Power	--	Compulsory	3	2	--	5	20	80	--	25	--	125	125
EE483	Instrumentation and Control	--	Compulsory	4	2	--	6	20	80	--	--	25	125	125
EE484	Testing and Maintenance of Electrical Equipment	EE387	Compulsory	4	2	--	6	20	80	--	--	50	150	150
EE485	Switchgear and Protection	--	Compulsory	3	2	--	5	20	80	--	25	--	125	125
EE486	Electrical Estimation and Costing	--	Compulsory	3	2	--	5	20	80	--	50	--	150	150
EE487	Utilisation of Electrical Energy	--	Compulsory	3	2	--	5	20	80	--	25	--	125	125
EE488	Energy Audit and Conservation	EE383	Compulsory	3	--	1	4	20	80	--	--	--	100	100
			Total	**23**	**20**	**1**	**44**	**190**	**560**	**50**	**175**	**75**	**1050**	**1050**

GROUP - D (All Compulsory - Non Credit Courses)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
NC481	Development of Soft Skills - I	--	Compulsory	--	2	--	--	--	--	25	--	--	25*	--
NC482	Development of Soft Skills - II	--	Compulsory	--	2	--	--	--	--	25	--	--	25*	--
			Total	**0**	**4**	**0**	**--**	**0**	**0**	**50**	**0**	**0**	**50***	**--**

Note:- * Grades will be awarded for GROUP - D (Non Credit Courses)

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

GOVERNMENT POLYTECHNIC, PUNE

(An autonomous Institute of Government of Maharashtra)

Programme Structure (180S)

DIPLOMA IN ELECTRICAL ENGINEERING

Level V – Diversified Courses (Any Three)

Course Code	Course Title	Prerequisite	Compulsory / Optional	Teaching Scheme				Examination Scheme						Class Declaration
				L	P	T	C	PA	TH	TW	OR	PR	TOTAL	
EE581	Industrial Automation	EE483	Optional	3	2	1	6	20	80	--	--	50	150	150
EE582	Power Electronics and Drives	EE388	Optional	3	2	1	6	20	80	--	--	50	150	150
EE583	Electrical Machine Design	EE388	Optional	3	2	1	6	20	80	--	50	--	150	150
EE584	Micrcontroller and Applications	ET390	Optional	3	2	1	6	20	80	--	--	50	150	150
EE585	Illumination Engineering	EE487	Optional	3	2	1	6	20	80	--	50	--	150	150
EE586	Electrical Building Maintenance System	EE383	Optional	3	2	1	6	20	80	--	50	--	150	150
EE587	Modern Electric Traction	EE487	Optional	3	2	1	6	20	80	--	50	--	150	150
			Total	**9**	**6**	**3**	**18**	**60**	**240**	**0**	**50**	**100**	**450**	**450**

	TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
	L	P	T	C	PA	TH	TW	OR	PR	Total	
Grand Total	**95**	**74**	**11**	**180**	**610**	**2240**	**375**	**425**	**775**	**4425**	**1500**

Abbrevations: L - Lecture, P - Practical, C - Credits, PA - Progressive Assessment, PR - Practical, TW - Term Work, OR - Oral, @ - Compulsory

Each Lecture / Practical period is of one clock hour

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Government Polytechnic, Pune

Department of Electrical Engineering

Sample path (GS-1) for regular student I[st] Shift in 180S

Course Code	Course Title	Pre-requisite	Teaching Scheme				Exam Scheme							
			L	P	T	C	PA	TH	TW	OR	PR	TOT	CD	
			1st Semester											
HU181	ENGLISH		2	2	0	4	20	80	25	0	0	125	--	1st Sem
SC181	APPLIED MATHEMATICS - I		3	0	1	4	20	80	0	0	0	100	--	
SC183	ENGINEERING PHYSICS		3	2	0	5	20	80	0	0	50	150	--	
CM286	COMPUTER FUNDAMENTALS		1	2	0	3	0	0	25	0	50	75	--	
[illegible]84	ENGINEERING DRAWING		2	2	0	4	0	0	50	0	0	50	--	
WS281	WORKSHOP PRACTICE		0	4	0	4	0	0	50	0	0	50	--	
NC481	DEVELOPMENT OF SOFT SKILLS - I		0	2	0	2	0	0	25	0	0	25	--	
7		Total	11	14	1	26	60	240	175	0	100	575		
			2nd Semester											
HU182	COMMUNICATION SKILLS		2	2	0	4	20	80	0	25	0	125	--	2nd Sem
SC182	APPLIED MATHEMATICS - II		3	0	1	4	20	80	0	0	0	100	--	
SC184	ENGINEERING CHEMISTRY		3	2	0	5	20	80	0	0	50	150	--	
AM281	ENGINEERING MECHANICS		4	2	0	6	20	80	25	0	0	125	--	
CM287	C PROGRAMMING		2	2	0	4	0	0	0	0	50	50	--	
EE281	BASIC ELECTRICAL ENGINEERING		3	2	1	6	20	80	0	0	50	150	--	
EE385	ELECTRICAL MATERIALS AND WORKSHOP		1	2	0	3	0	0	50	0	0	50	--	
7		Total	18	12	2	32	100	400	75	25	150	750		

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Government Polytechnic, Pune

Department of Electrical Engineering

Sample path (GS-1) for regular student I[st] Shift in 180S

						3rd Semester								
ET281	BASIC ELECTRONICS		4	2	0	6	20	80	25	0	50	175	--	3rd Sem
ME285	FUNDAMENTALS OF MECHANICAL ENGINEERING		2	2	0	4	0	0	0	50	0	50	--	
SC282	ENGINEERING MATHEMATICS		2	0	1	3	20	80	0	0	0	100	--	
EE282	ELECTRICAL CIRCUITS AND NETWORKS		3	2	1	6	20	80	0	0	50	150	--	
EE383	ELECTRICAL MEASUREMENTS		3	2	0	5	20	80	0	0	50	150	--	
EE386	COMPUTER AIDED ELECTRICAL DRAWING AND MODELLING		0	2	0	2	0	0	0	0	50	50	--	
EE387	ELECTRICAL MACHINES - I	EE281	3	2	1	6	20	80	0	0	50	150	--	
7	Total		17	12	3	32	100	400	25	50	250	825		
						4th Semester								
EE381	MINI PROJECT		0	2	0	2	0	0	25	25	0	50	--	4th Sem
EE384	ELECTRICAL POWER GENERATION		3	1	0	4	20	80	0	25	0	125	--	
EE388	TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER		3	2	0	5	20	80	0	25	0	125	--	
EE389	INSTRUMENTATION AND CONTROL		3	2	0	5	20	80	0	25	0	125	--	
ET390	DIGITAL ELECTRONICS AND MICROPROCESSOR	ET281	3	2	0	5	20	80	0	0	50	150	--	
AU481	ENVIRONMENTAL SCIENCE		0	2	0	2	0	0	50	0	0	50	--	
AU483	RENEWABLE AND SUSTAINABLE ENERGY MANAGEMENT		2	0	0	2	20	80	0	0	0	100	--	
MA482	INDUSTRIAL ORGANISATION AND MANAGEMENT		3	0	0	3	20	80	0	0	0	100	--	
NC482	DEVELOPMENT OF SOFT SKILLS - II		0	2	0	2	0	0	25	0	0	25	--	
9	Total		17	13	0	30	120	480	100	100	50	350		

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

LEVEL-I

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
HU181	English	2	2	--	4	20	80	25	--	--	125
HU182	Communication Skills	2	2	--	4	20	80	--	25	--	125
SC181	Applied Mathematics - I	3	--	1	4	20	80	--	--	--	100
SC182	Applied Mathematics - II	3	--	1	4	20	80	--	--	--	100
SC183	Engineering Physics	3	2	--	5	20	80	--	--	50	150
SC184	Engineering Chemistry	3	2	--	5	20	80	--	--	50	150

Programme : **Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**

Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/15/16/17/18

Name of Course : **English**

Course Code : **HU181**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	02	32
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	Two Class Tests each of 60 Minutes	03 Hrs.	---	---	---
Marks	20	80	---	---	25

Course Rationale:

This is been noticed that diploma pass outs lack in grammatically correct written and oral communication in English. It is also been noticed that communication is not a problem of students, communication in correct English is the basic problem of Diploma pass outs. Students will have to interact in this language so far as their career in industry is concerned. In order to enhance this ability in students English is introduced as a subject to groom their personality.

Course Objectives:

After studying this course, the student will be able to

- Comprehend the passage.
- Answer correctly the questions on unseen passages.
- Increase the vocabulary.
- Apply rules of grammar for correct writing.
- Speak correct English

Course Contents:

Chapter No.	Name of Topic/Subtopic		Hrs	Weightage
	1.1	Tenses : Past Perfect, Past Perfect Continuous	12	20
	1.2	Types of Sentences: Simple, Compound and Complex.		
	1.3	Verbs		
	1.4	Reported Speech : Complex Sentences		
	1.5	Uses of 'too' and 'enough' : Conversion and Synthesis		
	1.6	Modal Auxiliary : Will, shall, can, could		
	1.7	Articles		
	1.8	Preposition		
	1.9	Conjunctions Interjections		
	1.10	Affirmative and negative, interrogative		
	1.11	Question tag		
2		**PARAGRAPH WRITING**		
		Types of paragraphs (Narrative, Descriptive, Technical)	04	10
3		**COMPREHENSION**		
		Unseen passages	10	40
4		**VOCABULARY**		
		Homophones: To understand the difference between meaning	04	06

		and spelling of words		
		Vocabulary : Understanding meaning of new words	02	04
	Total		32	80

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs.
1	Building of Vocabulary – 2 assignments 25 new words for each assignment with sentence	04
2	Conversational Skills – Role play student will perform the role on any 6 situations. Dialogue writing for the given situations.	04
3	Grammar – 2 assignments	04
4	Write paragraphs on given topics. 2 assignments.	04
5	Errors in English 2 assignments. Find out the errors and rewrite the sentences given by the teacher.	04
6	Essay writing 2 assignments. Write 2 assays on topic given by the teacher.	04
7	Biography (Write a short biography on your role model approximately in 250-300 words)	04
8	Idioms and phrases Use of idioms and phrases in sentences(20 examples)	02
Total		32

The term work will consist of 10 assignments.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	GRAMMAR	Class room Teaching
2	PARAGRAPH WRITING	Class room Teaching
3	COMPREHENSION	Class room Teaching
4	VOCABULARY	Class room Teaching

Reference Books:

Sr. No.	Author	Title	Publication
1	J.D.O. Connors	Better English Pronunciation	London Cambridge University Press ELBS
2	Geofrey Leech	A communicative Grammar of English	Essex Longman Group Ltd. : ELBS
3	Randolf Quirk	University Grammar of English	Essex Longman Group Ltd. : ELBS

Learning resources: Books, Audio Visual aids

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	GRAMMAR	---	10	10	20
2	PARAGRAPH WRITING	---	05	05	10
3	COMPREHENSION OF UNSEEN PASSAGES	---	30	10	40
4	VOCABULARY/HOMOPHONES	02	04	04	10
	Total	**02**	**49**	**29**	**80**

(M.A. Surdikar)
Prepared By

(S.V. Chaudhari)
Member Secretary, PBOS

(C.Y. Kotewar)
Chairman, PBOS

Programme : **Diploma in** CE/EE/ET/ME/MT/CM/IT

Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/15/16/17/18/19

Name of Course : **Communication Skills**

Course Code : **HU182**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	**02**	**32**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	**One Class Tests of 60 Minutes and an Oral**	**03 Hrs.**	---	---	---
Marks	**20**	**80**	---	**25**	--

Course Rationale:

Classified under human sciences this subject is intended to introduce students with the process of communication so that they can identify conditions favorable to effective communication. They will also be taught basic and applied language skills viz. listening, speaking, reading and writing – all useful for the study of a technical course and communication. Specifically, writing and oral presentation skills are two top ranking capabilities needed for professional careers and must be developed systematically.

Course Objectives:

After studying this course, the student will be able to

- Understand and use the basic concept of communication and principles of effective communication in an organized set up and social context.
- Give a positive feedback in various situations to use appropriate body language & to avoid barrier for effective communication.
- Write the various types of letters, reports and office drafting with the appropriate format.
- Communicate with the Industry Professionals.

Course content:

Chapter No.	Name of Topic/Subtopic		Hrs	Marks
1	**Basic Concepts And Principles Of Communication**			
	1.1	**The Communication Event** The Communication event : Definition The elements of communication : The sender, receiver, message, channel, feedback and conte	12	24
	1.2	**The communication Process** The Communication Process : Definition Stages in the process : defining the context, knowing the audience, designing the message, encoding, selecting the proper channels, transmitting, receiving, decoding and giving feedback.		
	1.3	**Principles of Effective communication** Effective Communication : definition Communication Barriers and how to overcome them at each stage of communication process. Developing effective message: Thinking about purpose, knowing the audience, structuring the message, selecting proper channels, minimizing barriers and facilitating feedback.		
2	**Organizational Communication**			
	2.1	What is an organization? Goal, structure, hierarchy. Pattern of communication : Upward, Downward, Horizontal and Grapevine	04	12
3	**Non-verbal Communication**			
	3.1	Non Verbal Codes : Kinesics (eye-contact, gesture, postures, body movements and facial expressions) Proxemics (using space), Haptics (touch), Vocalics (aspect of speech like tone, emphasis, volume, pauses etc.) Physical Appearance, Chronemics (manipulating time), Silence.	06	12
4	**Business Correspondence and Office Drafting**			
	4.1	Business Correspondence : Letter of Enquiry, Order letter, Complaint Letter and Adjustment letter.	10	32
	4.2	Report Writing :		

		Feasibility report/ Survey Report, Accident Report and Progress Report		
	4.3	Office Drafting : Circular, Notice and Memo		
	4.4	Job Application with resume.		
	Total		**32**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs.
1	Self Introduction	02
2	Elocution	04
3	Extempore	04
4	Mock Interview	04
5	Debate	02
6	Variety Application/Reports	02
7	Writing Paragraphs on Technical Subjects	02
8	Business letter	02
9	Individual/Group Presentation on identified topics	02
10	Group discussion	02
11	Role play	06
	Total	**32**

Text Books:

Sr. No.	Author	Title	Publication
1	MSBTE	Communication skills	MSBTE

Reference Books:

Sr. No.	Author	Title	Publication
1	Joyeeta Bhatacharya	Communication skills	Macmillan Co.
2	Sarah Freeman	Written communication in	Orient Longman Ltd.

		English	
3	Krishna Mohan and Meera Banerji	Developing Communication skills	Macmillan India Ltd.

Learning resources: Books, Audio Visual aids

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Basic Concepts and Principles of communication	08	08	08	24
2	Organizational communication	04	04	04	12
3	Non Verbal communication	---	---	12	12
4	Business Correspondence and Office Drafting	---	---	32	32
	Total	**12**	**12**	**56**	**80**

(Prof. M.A. Surdikar)
Prepared By

(Prof. S.V. Chaudhari)
Member Secretary, PBOS

(C.Y.Totewar)
Chairman, PBOS

Programme : **Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**

Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/15/16/17/18/19

Course : **Communication Skills**

Course Code : **HU182**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	02	32
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	One Class Tests of 60 Minutes and an Oral	03 Hrs.	--	--	--
Marks	20	80	--	25	--

Course Rationale:

Classified under human sciences this subject is intended to introduce students with the process of communication so that they can identify conditions favorable to effective communication. They will also be taught basic and applied language skills viz. listening, speaking, reading and writing – all useful for the study of a technical course and communication. Specifically, writing and oral presentation skills are two top ranking capabilities needed for professional careers and must be developed systematically.

Course Objective:

After studying this course, the student will be able to

- Understand and use the basic concept of communication and principles of effective communication in an organized set up and social context.
- Give a positive feedback in various situations to use appropriate body language & to avoid barrier for effective communication.
- Write the various types of letters and office drafting with the appropriate format.
- Communicate with the Industry Professionals.

Course content:

Chapter No.	Name of Topic/Subtopic		Hrs	Marks
1	**Basic Concepts And Principles Of Communication**			
	1.1	**The Communication Event** The Communication event : Definition The elements of communication: The sender, receiver, message, channel, feedback	12	24
	1.2	**The communication Process** The Communication Process : Definition Stages in the process : defining the context, knowing the audience, designing the message, encoding, selecting the proper channels, transmitting, receiving, decoding and giving feedback.		
	1.3	**Principles of Effective communication** Effective Communication : definition Communication Barriers and how to overcome them at each stage of		

		communication process. Developing effective message: Thinking about purpose, knowing the audience, structuring the message, selecting proper channels, minimizing barriers and facilitating feedback.		
2	**Organizational Communication**			
	2.1	What is an organization? Goal. Patterns of communication : Upward, Downward, Horizontal and Grapevine	04	12
3	**Non-verbal Communication**			
	3.1	Non Verbal Codes : Kinesics (eye-contact, gesture, postures, body movements and facial expressions) Proxemics (using space), Haptics (touch), Vocalics (aspect of speech like tone, emphasis, volume, pauses etc.) Physical Appearance, Chronemics (manipulating time), Silence.	06	12
4	**Business Correspondence and Office Drafting**			
	4.1	Business Correspondence : Letter of Enquiry, Order letter, Complaint Letter.	10	32
	4.2	Office Drafting : Circular, Notice and Memo		
	4.3	Job Application with Resume.		
	Total		**32**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs.
1	Self Introduction	02
2	Elocution	04
3	Extempore	04
4	Mock Interview	04
5	Debate	02
6	Variety Application/Reports	02
7	Writing Paragraphs on Technical Subjects	02
8	Business letter	02
9	Individual/Group Presentation on identified topics	02
10	Group discussion	02
11	Role play	06
	Total	**32**

Reference Books:

Sr. No.	Author	Title	Publication
1	MSBTE	Communication skills	MSBTE
2	Joyeeta Bhatacharya	Communication skills	Macmillan Co.
3	Sarah Freeman	Written communication in English	Orient Longman Ltd.
4	Krishna Mohan and Meera Banerji	Developing Communication skills	Macmillan India Ltd.

Learning Resources: Books, Audio - Visual aids

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Basic Concepts and Principles of communication	08	08	08	24
2	Organizational communication	04	04	04	12
3	Non Verbal communication	---	---	12	12
4	Business Correspondence and Office Drafting	---	---	32	32
	Total	**12**	**12**	**56**	**80**

Prepared by

(M.A.Surdikar)
Lect.in English

(S.V.Chaudhari)
Member Secretary PBOS

(M.S.Satarkar)
Chairman PBOS

Name of Programme : CE/EE/ET/ME/MT/CM/IT

Programme Code : 01/ **02**/ 03/ 04 / 05/ 06/ 07/ **16/22**

Name of Course : **Applied Mathematics –I**

Course Code : **SC 181**

Prerequisite : **Nil**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Term Work /Tutorial	01	16

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests of 60 minutes duration	3 Hrs	---	---	---
Marks	20	80	---	---	---

Course Aim:

The students of Diploma in Engineering and technology must acquire some essential competencies in Mathematics.

Course Objectives:

The students will be able to think logically and systematically. They will learn the importance of accuracy and develop attitude of problem solving with diligence and perseverance.

Course Contents:

Sr. No.	Name	Periods	Marks
1	**ALGEBRA**	**18**	**32**
	1.1 Logarithms: Definition , Laws of Logarithms , Simple examples based on laws.	02	04
	1.2 Determinants: Determinants of second and third orders, solution of simultaneous equations in two and three unknowns (Cramer's Method), Properties of determinants of order 3 and examples.	03	06
	1.3 Partial fractions: Rational fractions, resolving given rational fraction into partial fraction (Type : Denominator containing non-repeated,repeated linear factors and non repeated quadratic factor)	03	06
	1.4 Matrix Algebra - Definition of a matrix, types of matrices, Equal matrices, Addition, subtraction, multiplication of matrices. Scalar multiple of a matrix. Transpose of a matrix, Singular and Non singular matrix. Adjoint of a square matrix. Inverse of a matrix. Solution of simultaneous linear equations in 3 unknowns by Adjoint method.	06	10
	1.5 Binomial Theorem Definition of factorial notation, definition of permutation and combinations with formula, Binomial theorem for positive index, General term, Binomial theorem for negative index, Approximate value (only formula)	04	06
2.	**TRIGONOMETRY**	**20**	**32**
	2.1 Trigonometric ratios and fundamental identities.	04	08
	2.2 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), submultiples angle.	06	08
	2.3 Sum and product formulae.	06	08
	2.4 Inverse Circular functions. (definition and simple problems)	04	08

3.	**COORDINATE GEOMETRY**	**10**	**16**
	3.1 Straight Line Slope and intercept of straight line. Equation of straight line in slope point form, slope-intercept form, two-point form, two-intercept form, normal form. General equation of line. Angle between two straight lines condition of parallel and perpendicular lines. Intersection of two lines. Length of perpendicular from a point on the line and perpendicular distance between parallel lines.	06	10
	3.2 Circle Equation of circle in standard form, Centre-radius form, Diameter form, two intercept form. General equation of a circle and its centre & radius.	04	06

Reference Books :

Author	Title	Publisher
Shri S.P. Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Griha
Shri S.L. Loney	Plane Trigonometry	Macmillan and London
Shri H.K. Dass	Mathematics for Engineers (Vol.I)	S.Chand and Comp.
Shri Shantinarayan	Engg. Maths Vol.I and II	S. Chand and Comp.

Learning Resources – Chalk, Board etc.

Specification Table :

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Algebra	08	16	08	32
2.	Trigonometry	08	16	08	32
3.	Co-ordinate Geometry	04	08	04	16
	Total	20	40	20	80

(Prof. V. B. Shinde)
Prepared By

(Prof. S. V. Choudhary)
Member Secretary, PBOS

(Prof. C. Y. Totewar)
Chairman, PBOS

Name of Programme : CE/EE/ET/ME/MT/CM / IT

Programme Code : 01/ 02/ 03/ 04 / 05/ 06 / 07/ **16/22**

Name of Course : **Applied Mathematics –II**

Course Code : **SC 182**

Prerequisite : **NIL**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Term Work /Tutorial	01	16

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests of 60 minutes duration	3 Hrs	---	---	---
Marks	20	80	---	---	---

Course Aim:

This subject intends to teach students basic facts, concepts, principles and procedure of Mathematics as a tool to analyze Engineering problems and as such it lays down foundation for the understanding of engineering science and core technology subjects.

Course Objectives:

The students will be able to,

1. Under stand basic facts of Mathematics about the field of analysis of any Engineering problem.
2. Know the standard ways in which the problem can be approached.
3. Apply basic concepts to engineering problems.

Course Contents:

Sr.No	Name	Periods	Marks
1	**FUNCTIONS AND LIMITS :**	**13**	**18**
	1.1 Functions: Concept of functions, Types of functions; (only definitions)	03	06
	1.2 Limits: Concept of limits and limits of functions. (algebraic, trigonometric, logarithmic and exponential.)	10	12
2	**DERIVATIVES:**	**16**	**24**
	2.1 Definition of the derivative, derivatives of standard Functions.	03	04
	2.2 Differentiation of sum, difference, product and quotient of two or more functions	03	04
	2.3 Differentiation of composite, inverse, implicit functions.	04	06
	2.4 Differentiation of parametric exponential and logarithmic Functions.	04	06
	2.5Successive differentiation.	02	04
3	**APPLICATIONS OF DERIVATIVES:**	**05**	**08**
	3.1 Geometrical meaning of derivative (Equations of tangents and Normals)	03	04
	3.2 Maxima and minima of functions.	02	04
4.	**VECTORS**	**06**	**14**
	4.1 Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication)	01	02
	4.2 Dot (Scalar) product with properties.	02	04
	4.3 Vector (Cross) product with properties.	02	04
	4.4 Workdone and moment of force about a point & line	01	04

5.	**NUMERICAL METHODS**	**08**	**16**
	5.1 Solution of algebraic equations Bisection method, Regulafalsi method and Newton – Raphson method.	04	08
	5.2 Solution of simultaneous equations containing 2 and 3 unknowns Gauss elimination method. Iterative methods- Gauss Seidal and Jacobi's method	04	08
		48	**80**

Reference Books:

Author	Title	Publisher
Vishwanath	Engineering Mathematics Vol.I	Satya Prakashan, New Delhi
S.P. Deshpande	Mathematic for polytechnic students I and II	Pune Vidyarthi Griha Prakashan
H.K. Dass	Mathematics for Engineering Vol-I	S.Chand and Company
Shantinarayan	Engineering Mathematics vol-I and II	S.Chand and Company

Learning Resources: Chalk, Board etc.

Specification Table:

Sr.No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	**FUNCTION AND LIMITS**	04	08	06	18
2	**DERIVATIVES**	08	16	00	24
3	**APPLICATIONS OF DERIVATIVES**	00	00	08	08
4	**VECTORS**	04	04	06	14
5	**NUMERICAL METHODS**	04	04	08	16
	Total	20	32	28	80

(Prof. V. B. Shinde)	(Prof. S. V. Choudhary)	(Prof. C. Y. Totewar)
Prepared By	**Member Secretary, PBOS**	**Chairman, PBOS**

Name of Programme : CE /EE / ET/ME / MT/CO/IT

Programme code : 01/02/03/04/05/06/07/16/22

Name of Course : **Engineering Physics**

Course Code : **SC183**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1hr	3 Hrs	2 Hrs	---	---
Marks	20	80	50	--	---

Course Aim:

1. To understand various phenomena, principles and concepts in physics.
2. To understand the applications in Engineering Physics.
3. To solve the applied numerical problems.

Course Objective:

1. The student should able to appreciate the role of physics.
2. The student should able to think in scientific manner and apply the basic knowledge in different situations.

Course Contents :

Sr. No	Topic / Sub topic	Hrs	Weightage
1	**Motion**	06	08
	1.1 Introduction **1.2 Circular Motion**: UCM, angular displacement, angular velocity, angular acceleration, radial velocity, tangential velocity, periodic time, frequency, relation between linear and angular velocity, explanation of centripetal and centrifugal force, with application, relation between velocity frequency and wavelength. **1.3 SHM**: Definition, SHM as a projection of UCM on the diameter, Equation of SHM, displacement and graphical representation.		
2	**Properties of Matter**	08	12
	2.1 Surface Tension : Molecular theory of surface tension, Cohesive and adhesive forces, Angle of contact, shape of liquid surface in capillary tube, capillary action (Examples). Surface tension by capillary rise method, (no derivation), simple problem, effect of impurity and temperature on surface tension. **2.2 Viscosity:** Definition, velocity gradient, Newton's & Stokes' law of viscosity, terminal velocity, coefficient of viscosity by stokes method(no derivation), type of flow of liquid - steam line flow, turbulent flow, Reynolds's number (significance), applications and simple problems. **2.3 Elasticity:** Elastic, plastic and rigid bodies, stress and strain, Hook's law, types of elastic modulii with its relation, problems. Behavior of wire under continuously increasing load.		
3	**Sound**	03	06
	Wave motion, Transverse and longitudinal waves, free and forced vibrations, Resonance - explanation and example. absorption, reflection and transmission of sound.		
4	**Heat**	04	06
	Explanation of Gas laws, Boyle's law, Charles's law, Gay Lussac's law, General Gas Equation, problems on gas laws, units of temperature ^0C, ^0K with their conversion, absolute scale of temperature, modes of heat transfer, conduction, convection and radiation.		

5	**Optics**	06	12
	5.1 Introduction to reflection and refraction of light, Snell's law, physical significance of refractive index, critical angle, total internal refraction of light. **5.2 Fiber optics** : Propagation of light through optical fiber, numerical aperture, types of optical fibers, applications and comparison with electrical cable. **5.3 LASER:** Definition, spontaneous and stimulated emission, population inversion, He-Ne laser- construction and working, applications and properties of LASER.		
6	**Electrostatics**	06	10
	6.1 Electric charge, Coulomb's law of charges, unit charge,electric field, intensity of electric field, electric lines of forces (properties), electric flux, flux density. **6.2 Electric potential:** explanation, definition, potential due to a point charge, potential due to a charged sphere, absolute electric potential, simple problems.		
7	**Current Electricity**	06	10
	7.1 Current, resistance, specific resistance, Whetstone's network, meter bridge, balancing condition of meter bridge, measurement of unknown resistance using meter bridge, problems. **7.2 Principle of potentiometer,** potential gradient, E.M.F., comparison of E.M.F. using potentiometer. **7.3 Electric work**, electric power, energy, units and calculations of electric bill.		
8	**Electromagnetism**	03	06
	Magnetic effect of electric current, Ampere's rule, intensity of magnetic field, magnetic induction, Biot- Savert's Law (Laplace's Law), Fleming's left hand rule, force experienced by current carrying straight conductor placed in magnetic field, problems.		
9	**Modern Physics**	06	10
	9.1 X- ray's, principle, production, properties and applications. **9.2 Photo electricity**: Planks quantum theory, photoelectric effect (circuit diagram and working), threshold frequency, stopping potential, work function, Einstein's photoelectric equation, photocell, problems.		
	Total	**48**	**80**

List of Practical's:

Sr. No.	Name of Experiment
1	Use of vernier calliper to measure the dimensions of different objects.
2	To understand the concept of error in instrument and to measure the dimensions of different objects using micrometer screw gauge.
3	To determine the velocity of sound using resonance tube method.
4	To determine period of simple pendulum.
5	To determine surface tension by capillary rise method.
6	To determine the specific resistance using Ohm's law
7	To understand the concept of Whetstone's network and to determine the specific resistance using the meter bridge.
8	Comparison of EMF using single cell method.
9	To understand the concept of viscosity and hence to determine the coefficient of viscosity using Stokes' method.
10	Study of concept of total internal reflection.
11	Study of characteristics of photoelectric cell.
12	To determine permittivity of free space.

Reference Books:

Author/s	Title	Publisher
R.K. Gaur and S. L. Gupta	Engineering Physics	Dhanpat Rai and Sons Publications
Manikpure, Prakash Deshpande and Dagwar	Basic Applied Physics	S. Chand and Co. New Delhi.
Modern Physics	Text book in Physics for diploma Engg. Student.	Sony Publications Pvt. Ltd.
Applid Physics	Schum's Series.	
Kshirsagar, Avdhanalu-	Engineering Physics	

Learning Recourses :

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's

6. Models 7. Experimentation 8. Diagram Demonstration

Specification Table :

Range of Marks for numerical problems: 30

Note: Figures in the bracket indicate the marks for which question will be set to account for internal options.

Sr. no.	Topic	Cognitive Level Knowledge	Comprehension	Applications	Total
1	General Physics	4(4)	3(2)	1(2)	6(8)
2	Properties of matter	4(5)	2(3)	2(4)	8(12)
3	Sound	1(2)	1(2)	1(2)	3(6)
4	Heat	2(2)	1(2)	1(2)	4(6)
5	Optics	3(6)	2(3)	1(3)	6(12)
6	Electrostatics	2(4)	2(4)	2(2)	6(10)
7	Current Electricity	3(4)	1(3)	2(3)	6(10)
8	Electromagnetism	1(3)	1(2)	1(1)	3(6)
9	Modern Physics	3(5)	2(3)	1(2)	6(10)

(Prof. Bhide) (Prof. Bhadar)

Prepared By

(Prof. S. V. Choudhary)

Member Secretary, PBOS

(Prof. C. Y. Totewar)

Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Programme : Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM

Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/15/16/17/18

Name of Course : ENGINEERING CHEMISTRY

Course Code : SC184

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Term Work /Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests of 60 minutes duration	03 Hrs	02 Hrs	--	--
Marks	20	80	50	--	

COURSE AIM :

Applications of Material Science and Chemical Principles have resulted into the Development of new materials used in modern medicines and automobiles, synthetic fibers polymers, alloys, new energy sources and many other important products and processes.

Hence, Material Science is an important and expanding branch in scientific engineering and economic field of our society. Thus the principles of Material Science have a wide application in all the branches of engineering and technologies. In this syllabus, the coverage of various topics will orient the students to appreciate the principles Material Science in the fields of engineering and Technology.

The topic atomic structure includes the basic structure of matter, which governs the Mechanical, Electrical and Magnetic properties of the matter. Steels, alloys, plastic and Elastomers are included considering their present extensive use in automobiles, chemicals and heavy engineering industries. The contents of this curriculum which provide knowledge of cells and batteries, selection of appropriate materials for engineering applications and methods of protection by metallic and non-metallic coatings. This satisfies the need of the students to cope with the recent use of these materials and processes in their world of work.

Corrosion and methods of prevention will make students realize importance of care and maintenance of machines and equipments. Study of different polymers, insulators, adhesives and their chemical behavior will be useful in their applications in electrical appliances and electronics industries. Study of impurities and hardness in water and methods for water softening will help the students to make proper use of water. The knowledge of environmental pollution and its awareness is helpful to change the attitude towards society and development by caring approach.

Nanomateials are widely used in engineering field .It will help to understand the need of nonmaterial in different engineering fields.

COURSE OBJECTIVES :

The student will be able to

- Develop interest in the fundamental structure of matter, which governs the properties of matter.
- Understand applications of basic concepts in chemistry
- Understand various Chemical Technological processes
- Apply principles and concepts of chemistry, to Engineering situations.
- Identify and formulate the changes and materials
- Analyze the chemical changes and effects
- Appreciate effect of chemical changes.
- Aware and Care about the environment

COURSE CONTENT :

Sr No	Name of the Topic	Hours	Marks
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING** **1.1 Atomic Structure :** Definition of atom, structure of modern atom, Characteristics of fundamental particles of an atom, definition of atomic number, atomic mass number and their difference, Orbits: Bohr's energy levels, sub-energy levels, s, p, d, f orbital, shapes and description of s and p orbital. Definition and significance of quantum numbers:, Aufbau's principle, Hund's rule, orbital electronic configurations (s, p, d, f) of elements having atomic number 1 to 30, **1.2 CHEMICAL BONDING** • Definitions of valence electrons, valency. • Definition of electrovalency, positive and negative electrovalency, formation of Electrovalent compounds-*Nacl,Alcl*$_3$ Definition of covalency, single, double and triple covalent bonds, formation of Covalent compounds *H2O,CO2,N2*	04	08
2	**Electrochemistry .** **2.1 Introduction** Definition of an electrolyte, electrolysis ,ionization, Assumptions of Arrhenius theory of electrolytic dissociation degree of ionization ,factors affecting degree of ionization, Difference between atom and ion, Activity series ,Mechanism of electrolysis, of i)Cuso$_4$ solution by using platinum ,cu rods. **2.2 Faraday's law of electrolysis.** Statements, explanation Numerical examples based on Faraday's laws of electrolysis. **2.3 Cell and cell reactions** Concept of electrode potential, standard electrode potential (E^O), significance of oxidation –reduction potential, type of electrodes, reference electrode and indicator electrode. construction and working of hydrogen electrode and calomel electrode.EMF series and its application, constructions and working reactions of lead acid cell, Daniel cell with porous vessel and salt bridge. Applications of Electrolysis Electroplating and Electrore fining	08	12

3	**METAL AND ALLOYS** **3.1 METAL** Occurrence of metals, definitions of mineral, ore, flux, matrix, slag and metallurgy, mechanical properties of metal, flow chart showing different processes in metallurgy, classification, properties and application of carbon steel, heat treatment(definition, purposes and methods) **3.2 Alloys** Definition of alloy, purposes of making alloys with examples, classification of alloys(ferrous and non-ferrous), effects of alloying elements on the properties of steel(Ni, Co, Si, Mn, V, W) composition, properties and uses of heat resisting steel, magnetic steel ,shock resistance steel, stainless steel ,high speed steel spring steel, tool steel, duralumin, woods metal, brass and monel metal.	06	08
4	**4.1 PLASTIC AND RUBBER (POLYMER AND ELASTOMER)** Definition of monomer and polymer, types of polymer (Addition, and Condensation) Definition example-(formation of Polythene, PVC, Teflon, Bakelite) Thermo softening and thermosetting (definition and comparison), applications of Plastic based on its properties. Definition and applications of Conductive polymer, Definition of elastomer, isoprene unit. Natural rubber-drawbacks, vulcanization, properties of rubber and applications based on its properties. Difference between synthetic and natural rubber. **4.2 ENGG.MATERIALS-** Definition Properties and Applications of- 1) Cement and lime2) Ceramics and composites3) Glass and Insulating materials 4) Paint and adhesives.	05	10
5	**WATER** Definition of hard water and soft water, causes of hardness, types of hardness, analysis of degree of hardness in calcium carbonate equivalent(numerical), bad effect of hard water in industries (paper, textile, dye, sugar), removal of hardness by lime soda method, zeolite, ion exchange method, reverse osmosis, PH scale, applications of PH in engineering. Numerical based on PH and hardness.	05	08
6	**CORROSION** Definition, causes of corrosion types of corrosion-definition (atmospheric and electro chemical) Types of oxide films , mechanism of atmospheric and electrochemical corrosion (evolution of hydrogen, absorption of oxygen), factors affecting rate of atmospheric corrosion and electrochemical corrosion. Protection Methods-Galvanization and tinning processes, sherardizing, metal spraying , metal cladding.	05	08

7	**LUBRICANT** Definition and functions of lubricant, mechanism of lubrication(fluid film, boundary, extreme pressure lubrication), classification of lubricant, properties of lubricating oils(physical and chemical), selection of lubricant for light machines, I.C.E., gears, cutting tools, high pressure and low speed machines, transformers, spindles in textile industry, for refrigeration system.	04	08
8.	**FUELS** Definition, classification of fuels, characteristics of good fuel, comparison between solid, liquid and gaseous fuel, types of coal, analysis of coal by proximate and ultimate analysis, refining of crude petroleum, fractions obtained by distillation of crude oil, gasoline, kerosene, diesel as a fuel(properties and uses)	04	08
9.	**MATERIAL SCIENCE AND ENGINEERING** Definition of material science, terminology and scales, properties of materials, (mechanical, electrical, magnetic, optical, thermal with example) structure depended properties (example of hardness versus structure of steel.)Types of materials- metals, semiconductor, polymer ceramic and composites (examples and properties and applications).Engineering nanomaterial and its applications.	04	06
10	**ENVORNMENTAL EFFECT (AWARNESS LEVEL)** Definition, types of pollution, air, water, soil, sound, nuclear pollution. (Causes, effect, control method), E-waste (origin effect control) deforestation, ozone depletion, greenhouse effect, preventative environmental management activities.	03	06

LIST OF EXPERIMENTS:

SR NO.	NAME OF THE EXPERIMENT	Hours
1	Write the electronic configuration of atoms (atomic no.1-30) Write the formation of compounds Nacl, $AlCl_3$,H_2o,Co_2,N_2.	04
2	Determine acidic and basic radical from unknown solution (any two)	04
3	Measure the voltage developed due to chemical reactions by setting up Daniel cell.	02
4	To determine the percentage of iron in given steel sample by redox titration.	02
5	To determine total hardness of sample of water by EDTA method.	02
6	To determine chloride content in given sample of water by Mohr's method	02
	RIVISION /REPETATION(1TO6)	02
7	To determine the percentage of Ca content in cement.	02
8	To determine electrode potential of various metals to study their tendency to corrosion	02
9	To determine the acid value of lubricant by using KoH	02
10	To determine coefficient of viscosity by using Ostwald's viscometer.	02
11	To determine percentage of ash or moisture in a given coal sample by proximate analysis.	02
12	To determine the strength of hydrochloric acid by titrating against sodium hydroxide solution by using PH meter.	02
	RIVISION/REPETATION (7 TO 12)	O2

LEARNING RESOURSES-

Author	Title	Publisher
V. P. Mehta	Polytechnic Chemistry	Jain Brothers, New Delhi.
P.C. Jain and Monica Jain	Applied Chemistry	Dhanpat Rai and sons, New Del hi
M.M. Uppal	Engineering Chemistry	Khanna Publisher, Delhi.
S.N. Narkhede, M.M. Thatte	Applied Chemistry	Nirali Prakashan, Pune.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Atomic structure and chemical bonding.	04	2	2	08
2	Electrochemistry	04	06	02	12
3	Metal and alloys	04	02	02	08
4	Polymer ,Elastomer and Engg materials	03	02	03	08
5	Water	02	03	03	08
6	Corrosion	04	02	02	08
7	Lubricant	03	03	02	08
8	Fuel	03	03	02	08
9	Material science and Engineering.	02	02	02	06
10	Environmental effects	02	02	02	06
	Total	31	27	22	80

(Smt.K. V. Mankar) Prepared by

(S.V. Chaudhari) Member Secretary, PBOS

(C.Y.Totewar) Chairman, PBOS

		5. Turns winding section 6. Temperature rise 7. Space factor 8. Design problem

List of Practical/Experiments/Assignments:

Sr. No	Name of practical/Experiment/Assignment
1	Design of three phase transformer 1)Calculations of dimensions.2)Calculations of windings.3)Calculations of core.4)Calculations of cooling requirements.5)Prepare design data sheet. 6)Prepare drawings as per design
2	Design of small single phase transformer 1) Calculations of dimensions 2) Calculations of windings 3) Calculations of core 4) Prepare design data sheet 5) Prepare drawings as per design
3	Design of three phase induction motors 1) Calculations of dimensions 2) Calculations of windings 3) Calculations of core stator and rotor. 4) Calculations of cooling requirements. 5)Prepare design data sheet 6) Prepare drawings as per design
4	Design of single phase induction motors 1) Calculations of dimensions. 2) constructional details of single phase induction motor
5	Report on design of magnet coil.

InstructionalStrategy:

Sr.No.	Topic	InstructionalStrategy
1.	**Introduction to Design of three phase transformer**	Lecture,Method,ChalkBoardtechnique
2.	**Design of Three phase Transformers**	Lecture,Q/Atechnique
3.	**Cooling of transformers**	Lecture,Q/Atechnique
4.	**Design of single phase shell Type Transformers**	LectureMethod,Q/Atechnique
5.	**Introduction to design of Induction Motors**	LectureMethod,Q/A,technique
6.	**Introduction to design of single phase Induction Motors**	Lecture Method, Q/A, technique
7.	**Design of Magnet coils**	Lecture Method, Q/A, technique

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

LEVEL-II

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
AM281	Engineering Mechanics	4	2	--	6	20	80	25	--	--	125
CM286	Computer Fundamentals	1	2	--	3	--	--	25	--	50	75
CM287	C Programming	2	2	--	4	--	--	--	--	50	50
EE281	Basic Electrical Engineering	3	2	1	6	20	80	--	--	50	150
ET281	Basic Electronics	4	2	--	6	20	80	25	--	50	175
ME284	Engineering Drawing	2	2	--	4	--	--	50	--	--	50
ME285	Fundamentals of Mechanical Engineering	2	2	--	4	--	--	--	50	--	50
WS281	Workshop Practice	--	4	--	4	--	--	50	--	--	50

GROUP - B (Any One)

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
HU281	Industrial Psychology	2	--	1	3	20	80	--	--	--	100
SC282	Engineering Mathematics	2	--	1	3	20	80	--	--	--	100

Elect. Engineering Dept.
Government Polytechnic
Pune 411 016

Programme Code : 01/02/04/05/15/16/18/19/22/24

Name of Course : Engineering Mechanics

Course Code : AM 281

Teaching Scheme :

	Hours/Week	Total Hours
Theory	4	64
Practical	2	32

Evaluation Schemes :

	Progressive Assesment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	Two class tests, Each of 60 minutes	3 Hours	-	-	-
Marks	20	80	-	-	25

Course Rationale :

To find solutions to various practical problems, it is essential for the student to study and get acquainted with the various aspects in Statics and Dynamics. The fundamental concepts to be studied in this ciurse are required for study of strengh of materials, Mechanics of Structures and other course of Mechanical & Civil Engineering to be studied at higher level.

Course Objectives :

After studying this course, the student will be able to

i Understand various concepts & principles in Engineering Mechanics

ii Apply those principles for evaluating various problems coming across various fields of engineering.

Course Content :

Chap. No	Name of Topics / Sub Topic	Hrs	Weigh tage
1	**Introduction**	02	02
	1.1 Fundamental Concepts such as Fundamental Units, Deprived unit, system of uniy, Scalars, Vectors.		
	1.2 Mechanics, Statics, Dynamics, Kinematics, Kinetics.		
	1.3 Gravity, Mass, Weight, Inertia, Newton's law of Gravitation and Newton's law of motion.		
2	**Resolution and composition of Forces**	08	12
	2.1 concept of force, unit force, graphical represntation, Principle of transmissibility.		

Elect. Engineering Dept.
Government Polytechnic
Pune 411 016

	2.2 System of forces, coplanar, non coplanar, concurrent non-concurrent, parallel.		
	2.3 Resolution of a force, resolved parts, orthogonal andnon-orthogonal components of a force.		
	2.4 Concept of composition & resultant of forces		
	2.5 Law of Paralleogram of forces, Triangle law of forces, Polygon law of forces.		
	2.6 Moment of a force, Varignon'sTheorm, couple & characteristics of couple		
	2.7 Composition of Coplanar forces- Concurrent, parallel (like and unlike) non concurrent forces by analytical methods.		
3	**Equilibrium**	08	14
	3.1 Concepts of equilibrium, equilibrant, Relation between resultant &equilibrunt. Analytical conditions.		
	3.2 Equilibrium of coplanar concurrent forces, Lami's theorm and it's application.		
	3.3 Equilibrium of coplanar parallel and non concurrent forces.		
	3.4 Beams reaction - simply supported beams subjected to concentrated and distributed loads, beam suppoorted on roller and hinge supports, overhanging beams.		
4	**Centroid and Centre of Gravity**	08	10
	4.1 Concept of Centre of Gravity & Centroid.		
	4.2 Centroid of regular plane areas & compound areas consisting of regular plane areas. Centroid of hollow solids such as hollow cylinder, hollow cone hollow sphere.		
	4.3 Centre of gravity of simple solids-cylinder, cone, sphere etc. and C.G of compound solid objects made up of simple solids.		
5	**Friction**	10	12
	5.1 Introduction to Friction.		
	5.2 Types of friction, laws of static friction, coefficient of friction, angle of friction and angle of repose.		
	5.3 Equilibrium of body on horizontal & inclined planes.		
	5.4 Ladder friction.		
6	**Kinetics**	10	12
	6.1 Concept of force,mass, accleration, momentum, impulse,& impact.		
	6.2 Types of friction, laws of static friction, coefficient of friction, angle of friction and angle of repose.		
	6.3 Principles of conservation of momentum, principles - its application, recoil velocity of gun.		
7	**Work, Power, Energy**	8	8
	7.1 Defination and units of work, graphical representation of work, work done by constant and variable force.		
	7.2 Energy, forms, law of conservation of energy, work energy principle and it's applications.		

	7.3 Power- Defination, units.		
8	**Simple Machines**	10	10
	8.1 defination of simple machine, mechanical advantage, velocity ratio,, efficiency,. Relation between them, friction in machines.		
	8.2 Reversbility, law of machine, max MA and max efficiency.		
	8.3 study of machine - levers, pulleys, wheel and axle, screws, worm & worm wheel, winches, gears etc.		
	Total	**64**	**80**

Specification Table :

Sr.No	Topic	Cognitive Levels			
		Knowledge	Comprehension	Application	Total
1	Introduction	2	...	...	2
2	Resolution & composition of forces	2	4	6	12
3	Equilibrium	2	2	8	12
4	Graphic Statics	4	4	...	8
5	Centroid and centre of Gravity	2	2	4	8
6	Friction	2	2	6	10
7	Kinetics	2	2	6	10
8	Work, Power, energy	2	2	4	8
9	Simple lifting machines	2	4	4	10
	Total	**20**	**22**	**38**	**80**

List of Practicals / Experiments / Assisgnments :

Sr.No	Name of Experiment / Assignment	Hrs.
1	Law of polygon of Forces.	2
2	Law of Moments.	2
3	Lami's Theorem.	2
4	Beam Reactions.	2
5	Graphic Statics Two problems each on composition of concurrent and parallel forces.	6
6	Graphic statics- Two problems on beam reactions.	4
7	Centroid of regular and irregular Laminas	2
8	Determination of coefficient of friction for different surfaces.	2
9	To study various lifting machines - Differential axle and wheel, Worm and worm wheel,simple screw jack, Single purchase crab, Double purchase crab.	10
	Total	**32**

Instructional Strategy :

Sr.No	Topic	Instructional Strategy
1	Introduction	Lect. Method, demonstration
2	Resolution & composition of forces	Lect. Method, demonstration
3	Equilibrium	Lect.Methods, Transparencies
4	Graphic statics	Lect.Methods, Transparencies
5	Centroid and centre of Gravity	Lecture,Demonstration& Discuss.
6	Friction	Lect. Method, demonstration
7	Kinetics	Lect. Method, demonstration
8	Work, Power, Energy	Lect. Method, demonstration
9	Simple lifting machines	Lect. Method, demonstration

Text Books :

Sr.No	Author	Title	Publication
1	Junnarkar, Adavi	Applied Mechanics	Charotkar
2	Dafhe, Jamdar, Walawalkar	Applied Mechanics	SaritaPrakashan
3	Khurmi	Applied Mechanics	S.Chand

Refrence Boks :

Sr.No	Author	Title	Publication
1	Beer &Jhonson	Vector Mechanics For Engineers.(Statics and Dynamics)	Mc- Graw Hill Co., USA
2	McLean & Nelson (Schaum's series)	Engineering Mechanics	Mc- Graw Hill Co., USA
3	Timoshenko & Young	Engineering Mechanics	Mc- Graw Hill Co., USA

Prof.K.S.Shinde	**Prof.S.V.Chaudhari**	**Prof.C.Y.Totewar**
Prepared By	**Secretory,PBOS**	**Chaiman,PBOS**

Name of Programme : CE /EE / ET/ME / MT/CO/IT

Programme code : 01/**02**/03/04/05/08/21/22/23/24/15/**16**/17/18/19/**22**

Name of Course : **Computer Fundamentals**

Course Code : **CM 286**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	**1**	**16**
Term Work/Practical	**2**	**32**

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration			**2 hours**	--	**2 hours**
Marks			**50**	--	**25**

Course Rationale:

In this world of high speed computing it is essential for diploma in computer engineering students to know about device of computers, its operation and graphical base applications and latest technologies in the market.This course are designed for basic perspective for first year diploma students.

Course Objective:

After studying this course, the student will be able to

1. Use computer system effectively.
2. Describe and use different application software's.
3. Use the basic functions of an operating system.
4. Use five essential utility programs.
5. Compare major OS like Linux and MS-Windows
6. Understand working of input output devices.
7. Understand working of secondary storage devices.
8. Set the parameter required for effective use of hardware combined with and application software's
9. Understand connectivity, internet multimedia and web

Course Contents:

Sr. No.	Name of Topic/Sub topic		Hrs	Weightage
1	**Introduction to computer peripherals**		3	--
	1.1	Hardware: Input-output devices, CPU and general PC layout		
	1.2	Data storage devices: RAM, ROM, External storage – magnetic & USB		
2	**Introduction to system softwares**		3	--
	2.1	Operating systems: Introduction to various operating systems like DOS, Windows, Android, Unix, Linux.		
	2.2	Windows: working with Windows operating system		
	2.3	Utility software: Application and working of various utility softwares like Antiviruses, Internet browsers, Adobe reader, office suite, media players etc.		
3	**GUI Based Editing, Spreadsheets, Tables & Presentation**		8	--
	3.1	Application Software Common Features		
	3.2	Word Processors: Working with word processor for creating documents & drafts.		
	3.3	Spreadsheets :: Features Creating and Working with spread sheets		
	3.4	. Presentation Graphics : Features .Working with Presentation Graphics to create presentations		
	3.5	Software suites		
4	**Communication & Connectivity**		2	
	4.1	Introduction to communication systems: Telephone, fax, e-mails, messengers (chatting), voice messaging system(voice mail), video-conferencing system .		

List of Practical/Experiments/Assignments:

Sr. No:	Name of Practical/Experiment/Assignment	Hrs
1	Understanding computer layout and its peripherals.	2
2	Study of printing and scanning devices	2
3	Working with operating systems like windows XP and understanding the working environment (Desktop, My Computer, My Documents, Recycle bin, Programme files & control panel.)	2

4	Working with MS world (at least four programs including use of pictures/ clipart, word art, shapes, tables, mail merging options)	6
5	Working with MS Excel (at least three programs including creating spreadsheets, performing arithmetic operations, creating charts & graphs).	6
6	Working with MS Powerpoint (at least three programs including creating simple presentation, use of hyperlinks, use of animation).	6
7	Page setting, page layout and printing Word, Excel & powerpoint documents.	2
8	Study of different types of networks and communication devices.	2
9	Internet practices: i)Getting started with internet, ii) Use of search engines iii)creating an email account, iv)E-travel & E-trading .	2
10	Assignment on cyber laws and ethics.	2
	Total	32

Text Books:

Sr. No.	Author	Title	Publication
1	**Timothy J. O. Leary**	Computing Essentials	TMH
2	**Vikas Gupta**	Comdex Computer Course Kit	Dreamtech

Reference Books:

Sr. No.	Author	Title	Publication
1	**P.K. Sinha**	Computer Fundamentals	BPB
2	Henry C. Lucas, Jr.	Information Technology for Management	Tata McGraw Hill
3		Windows XP/2000/2003/ Vista Users Guide	Manuals

(Mrs Seema Kolhe **(S.V. Chaudhari)** **(C.Y.Totewar)**

Mr.S.S.Pathak)

Prepared by **Member Secretary, PBOS** **Chairman, PBOS**

Head, Engineering Deptt.
Government Polytechnic
Pune 411 016

Programme : Diploma in EE

Programme Code : 02 / 16

Name of Course : Programming In C

Course Code : CM287

Teaching Scheme:

	Hours/Week	Total Hours
Theory	02	32
Tutorial	00	00
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	--	--	--	--	---
Marks	--	--	50	--	--

Course Rationale:

This Course intends to develop programming skills in the students, using a popular structured programming language `C'. The students will learn step by step procedure of any program development process. The programming skills thus acquired using `C' language can be used for acquiring necessary programming skill to work with advance level programming languages which in turn will be helping in developing programs for the scientific, research and business purposes.

Course Content:

UNIT-1 Basics of 'C' HRS -02		
Major learning outcome		Topic and subtopics
1. 1	Basics of 'C'	• Development of 'C', Importance of 'C',
1.2	Comprehend general structure of 'C' program.	• General structure of 'C' program and standard directories, programming style • Advantages of C language. • Sample 'C' programs, execution of 'C' program
UNIT-2 Data Types & Character set HRS -04		
2. 1	Define C tokens	• C tokens:- keywords & identifiers, Character set.
2.2	Define constants, variables and data types used in C.	• Constants, variables. • Data types in C

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

2.3	Declare variables in 'C' program.	• Declaration of variables and rules for defining variables, assigning values to variables.
2.4	Use of symbolic constants in C program	• Defining symbolic constants.
2.5	Write and execute simple program in 'C'	• Simple Programme to illustrate the use of variables, constants and data types in C.
	UNIT-3 Operators & Expressions HRS -08	
3.1	State and explain arithmetic, relational and logical operators for forming expressions.	• Introduction of different types of operators and their symbolic representation. • Properties of operator • Priority of operator and their clubbing • Comma and conditional operator, Arithmetic operators, • Relational operators, Assignment operators and expressions, Logical operators, Bitwise operators.
3.2	Format input and output using 'C' statements.	• Formatted input and output in 'C'
	UNIT-4 Decision Statements HRS -04	
4.1	Develop programs using decision making statements in 'C' language.	• Conditional branching statements: If statement If-else statement, Nested If-else statement, If-else-if Ladder statement, switches statements. • Unconditional branching: goto statement.
	UNIT-5 Loop Control Statements HRS -04	
5.1	Develop programs using structured loop control statements in 'C' language.	• For loop, Nested for loop. • While loop. • Do while loop
	UNIT-6 Introduction of Arrays and String (One Dimensional) HRS -06	
6.1.	Define and Declare an Array	• Array Terminology:-definition and types of an array • A characteristic of an array. • Array Declaration
6.2	Initialize and access an array	• Array initialization • Accessing an array. • Storing value in an array (Bubble Sort)
6.2	Develop programs using array in 'C' language.	• Programs to illustrate use of an array in C
6.3	Define and Declare an array of characters	• Introduction to string or an array of characters.
6.4	Intialise and access an array of characters	• Initializing string variables.
6.5	Explain common operations performed on string.	• Reading and writing string . • String functions:-strcmp,strcpy,strcat,strstr
	UNIT-7 Introduction To User defined functions HRS-02	
7.1	Explain the Need of User defined Functions.	• Need of User defined Functions.
7.2	How a function is designed	• Elements of user defined functions:-Function defination,function call,function declaration
7.3	Design Functions	• Simple program to illustrate use of functions
	UNIT-8 File Management in C HRS-02	
8.1	Defining and opening and closing a file	• Naming a file. • Opening a file • Reading data from a file • Writing data to a file • Closing a file

8. 2	Input/output operations on files	• Standard I/O functions:-getc,putcgetw,putw,fprintf,fscanf

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Demonstration of Turbo-C Compiler, Creating a program, Compiling & linking executing programs.	02
2.	Write minimum 5 programs using Constants, Variables.	02
3.	Write minimum 5 programs using arithmetic expression.	04
4.	Write programs providing insight to formatted and unformatted input and output in	02
5.	Write minimum 5 programs providing understanding of Relational operators	02
6.	Write programs using logical and bitwise operators	02
7.	Develop programs using If, If-else, If-else-if and Nested If statements.	02
8.	Develop programs using break, continue, goto and switch statements.	02
9.	Write programs to understand simple For loop and nested loops.	02
10.	Write programs using While Loop and Do-while loop.	02
11.	Write programs on arrays. (Sorting, merging, finding particular value etc.) Write a programs on Strings	02
12.	Write a simple program to demonstrate the use of User defined function	02
13	Write a simple program to demonstrate the use of file handling operations	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Basics of 'C'	Demonstration of 'C' Compiler, Create simple Program
2	Data Types & Character set	Write 'C' programs based on declaring variables & Assigning values to variables.
3	Operators & Expressions	Explanation of operators, expressions & managing i/p & o/p operators
4	Decision Statements	Theoretical explanation + writing program using different control statements.
5	Loop Control Statements	Theoretical explanation + writing program using different control statements.
6	Introduction of Arrays and String	Theoretical explanation & implementation of arrays and strings
7	Introduction To User defined functions	Theoretical explanation of User defined functions and its necessity with simple program.
8	File Management in C	Theoretical explanation of and use of it

Text Books:

Sr. No.	Author	Title	Publication
1	E. Balagurusamy	Programming in ANSI 'C'	Tata- McGraw Hill pub.(Second Edition)

Reference Books:

Head. Engineering Deptt.
Government Polytechnic
Pune 411 016

Sr. No.	Author	Title	Publication
1	Yashwant Kanetkar	Let us 'C'	BPB Publication
2	Madhusudhan Mothe	C for Beginners	SPD Publication

Learning Resources: Black Board, LCD projector, White Board, Computer.

Prof.J.D.Naik,Prof.C.Y.Totewar
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Programme : Diploma in EE

Programme Code : 02 / 22 / 16

Name of Course : Basic Electrical Engineering

Course Code : EE281

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Tutorial	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	3 hrs	3 Hrs	---	---
Marks	20	80	50	--	--

Course Rationale:

This is an entry course to Electrical Engineering Diploma programme. The basic concepts, rules and laws of Electric and Magnetic Circuits must be studied & understood by students before studying Electrical Engineering Diploma Course. This course covers fundamentals of D.C. and A.C. circuits, electrostatics, electromagnetism and electrochemistry.

Course Content:

Major learning outcome		Topics and subtopics
	UNIT-1 D.C.Circuits	**HRS -06 (02) MARKS-10**
1.1	Explain the various basic parameters of DC circuits.	• Charge, Current, Potential, voltage, power, Energy Electrical Resistance and their Units. • Ohms law: applications and limitations. • Specific Resistance and its unit.
1.2	Identify the commonly used materials and components used in electrical engineering.	• Parameters affecting the resistance, Effect of temperature on resistance and temperature co-efficient. • Different types of resistors- fixed and variable color-code. • Conductors, Insulators, Semiconductors.

1.3	Apply voltage divider rule for series circuit and current division rule for parallel circuits	• Series and parallel circuits, division of voltage in series circuit. • Division of current in parallel circuit.
1.4	Explain the concept of ideal and practical voltage and current sources.	• Concept of Ideal and Practical Current Source and voltage source.
1.5	Convert the given Voltage source into Current source and Current source to Voltage source	• Source conversion.
1.6	Solve numerical problems.	• Simple Numerical on all above topics.
	UNIT-2 Energy Conversion HRS -08(03) MARKS-12	
2.1	Explain law of conservation of energy and role of electrical energy.	• Law of conservation of energy.
2.2	Define the terms work, power and energy.	• Definitions of Work, Power and Energy (both electrical and mechanical); • Conversion from Mechanical units into Electrical unit.
2.3	Describe the principle of energy from one form to another.	• Electro-mechanical energy conversion principle and EMF.
2.4	State the relation between torque & power.	• Relation between torque & power.
2.5	Define an efficiency.	• Concept of efficiency:-Concept of efficiency for conversion of energy from one form to another.
2.6	State joules law and its Applications.	• Joules law of heat and problems on heating based on a) Energy or power required to raise temperature of Water to given point or to melt a given metal. b) Energy or power required to raise mechanical load to given height e.g. lift, crane etc. c) H.P. rating of motor to lift water for given height.
	UNIT-3 Electrostatics HRS -10(03) MARKS-12	
3.1	Explain the concept of electric field.	• Electric Field:-Concept, Causes, shape, and effects of electric fields.
3.2	Define the terms related to Electrostatics.	• Electric charge, Laws of electrostatics, Electric field, Electrostatic induction, Electric flux, Flux Density, Electric field Intensity.
3.3	Explain the Concept of capacitance and working of capacitor.	• Capacitance:- capacitance of a parallel plate capacitor with single & composite dielectric medium. • Effects of Dielectrics. • Dielectric constant units. (Numerical).
3.4	State the factors affecting the capacitance of a capacitor.	• Factors affecting capacitance.
3.5	Define dielectric strength, breakdown voltage, permittivity.	• Dielectric strength ,breakdown voltage and permittivity.

3.6	State the different types of capacitors and dielectrics.	• Types of capacitor • Types of dielectrics.
3.7	Enlist the technical Specifications of capacitors.	• Specifications of capacitors:- rating of capacitance and tolerance, rated voltage, color code.
3.8	Calculate the capacitance in electrical circuits.	• Capacitors in Series and parallel:-Simple numerical.
3.9	Calculate the energy stored in Capacitors.	• Energy stored in capacitance (No Derivation but simple numerical).
UNIT-4 Electromagnetism HRS -10(03) MARKS-14		
4.1	Describe the various basic parameters of Magnetic field.	• Magnetic field:- magnetic flux, magnetic flux density, magnetic field strength, magneto motive force, reluctance, factors on which Reluctance depends, permeability.
4.2	Explain Laws and Rules applicable to the magnetic field produced by solenoid, current carrying conductor.	• Rules applied to magnetic field: - • Right hand rule. • Corkscrew's rule. • magnetic field produced by straight current carrying conductor. • Magnetic field of solenoid.
4.3	Give the comparison between Electric and Magnetic circuit.	• Comparison Between Electric and Magnetic circuit.
4.4	Explain Series and parallel magnetic circuits.	• Series and parallel magnetic circuits:- Simple series and parallel magnetic circuits (numerical on uniform & composite series magnetic circuits).
4.5	Explain Leakage Flux, Useful Flux & Fringing.	• Concept of Leakage Flux, Useful Flux & Fringing.
4.6	Describe the significance of Magnetization curve and Hysteresis loop	• Magnetization curve and Hysteresis loop:-Relation between B and H, Magnetization curve. • Practical importance of magnetization curve, Hysteresis loop, Hysteresis loss.
4.7	State and explain Fleming's left hand rule and application of it.	• Fleming's left hand rule :Force on current carrying conductor and correlate with motor action.
UNIT-5 Electromagnetic induction HRS -05(02) MARKS-12		
5.1	Define phenomenon of Electromagnetic induction.	• Electromagnetic Induction.
5.2	State and apply Faraday's law, Lenz's law, Fleming's right hand rule, Fleming's left hand rule.	• Faraday's law. • Lenz's law. • Fleming's right hand rule for Generators. • Fleming's left hand rule for Motors.
5.3	Differentiate between Statically and Dynamically induced EMF, self and mutual inductance.	• Statically and dynamically induced EMF. • Inductance: Self and Mutual Inductance.

		• Inductances in series.
5.4	Identify the different types of inductor and explain their applications.	• Types of Inductors and their Applications:- Air Cored Inductors Iron Cored Inductors Ferrite Cored Inductors.
5.5.	Calculate the energy stored in magnetic field.	• Energy stored in Magnetic field. (No derivation). • Simple numerical on self and Mutual induction
5.6	Define Eddy current and eddy current loss.	• Eddy current and eddy current loss.
UNIT- 6 A.C. Fundamentals HRS -04(02) MARKS-08		
6.1	Explain generation of alternating EMF.	• Principle of generating an alternating voltage.
6.2	Define various electrical parameters.	• Cycle, Time period, Frequency, Amplitude, Phase and Phase difference, Average value, R.M.S. value, Form factor, Peak Factor and Power Factor .
6.3	Derive equation for RMS and average value of sinusoidal wave.	• Derive equation for RMS and average value of sinusoidal wave.
6.4	Solve numerical based on AC fundamentals.	• Simple numerical on above topics.
UNIT-7 Storage Batteries HRS -05(01) MARKS-12		
7.1	Review of electrolysis terminology.	• Review of electrolysis terminology- Faraday's laws of electrolysis, Electrochemical voltage generation. • Batteries: An electrochemical source of energy.
7.2	List the various types of Batteries.	• Types of Batteries:-Primary, Secondary and fuel batteries.
7.3	Describe the construction and Working of various batteries.	• Dry cell-construction and working. • Lead acid storage cell—construction and working. • Nickel /Cadmium battery –construction and Working.
7.4	Explain the working of fuel cell.	• Fuel cell-definition exampleH2/O2 fuel cell [green fuel cell.
7.5.	Describe Electrical Characteristics of batteries.	• Battery connections. • Electrical characteristics of batteries. • Rating and efficiencies of batteries and numerical based on it. • Charging and discharging curves of batteries . • Methods of charging, • Series and parallel combinations of cells. • Testing and maintenance of batteries. • Applications.

7.6	Explain construction ,working of UPS/Inverter and its specification.	• Function and working of inverter & UPS w.r.t standby power source with connection diagram. • Determine the battery capacity for Inverter & capacity of UPS for a particular applications.(numerical).

Note: - 1.Teaching hrs in the bracket indicates tutorial Hrs.

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	To use rheostat as a potential divider and regulator.	02
2.	To verify the effect of temperature on resistance of conductor.	02
3.	Connect resistances in series to get required effective resistance and Verify	02
4.	Connect resistances in parallel and series to get required effective resistance and verify	02
5.	To verify the voltage & current division formulae for series and parallel circuits.	02
6.	Study of various types of capacitors and identification of capacitance value using color code and its verification using LCR meter.	02
7.	Verification of Fleming's left hand rule	02
8.	To plot B – H curve of a magnetic material on d.c. generator.	02
9.	Verification of Faraday's laws of electromagnetic induction & understanding of direction of induced e.m.f.	02
10.	To observe sinusoidal a.c. waveform on CRO and determination peak to peak value, R.M.S. value, form factor, peak factor, time period and frequency.	02
11.	To plot Charging curve of battery by different methods.	02

SUGGESTED LIST OF STUDENT ACTIVITIES FOR TUTORIAL

- Assignments on solving numerical
- Identify and select various measuring instruments as per required range
- Identify and select resistors based on color code
- Identify and select capacitors based on color code.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	D. C. Circuits	Lecture, Audio/ Visual CDS,Q/A & Problem solving
2	Energy conversion	Lecture, Audio/ Visual CDS, Q/A & Problem solving
3	Electrostatics	Lecture, Audio/ Visual CDS, Q/A & Problem solving
4	Electromagnetism	Lecture, Audio/ Visual CDS, Q/A & Problem solving
5	Electromagnetic induction	Lecture, Audio/ Visual CDS, Q/A & Problem solving
6	A.C. Fundamentals	Lecture, Audio/ Visual CDS, Q/A & Problem solving
7	Storage Batteries	Lecture, Audio/ Visual CDS, Q/A & Problem solving

Text Books:

Sr. No.	Author	Title	Publication
1	B.L. Theraja	Electrical Technology Vol. I	S. Chand Publication, Delhi
2	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Dlhi.

Reference Books:

Sr. No.	Author	Title	Publication
1	Edward Hughes	Electrical Technology	Low Price Edition
2	H. Cotton	Electrical Engineering	CBS Publishers & Distributors

Learning Resources: Books, Models, Charts and Drawings & Audio/ visual CDS.

Specification Table:

Sr. No.	Topic	Cognitive Levels			
		Knowledge	Comprehension	Application	Total
1	D. C. Circuits	02	04	04	10
2	Energy conversion	02	02	08	12
3	Electrostatics	02	04	06	12
4	Electromagnetism	04	04	06	14
5	Electromagnetic induction	02	04	06	12
6	A.C. Fundamentals	02	02	04	08
7	Storage Batteries	04	04	04	12
	Total	**18**	**24**	**38**	**80**

(Prof.J.D.Naik, Prof.M.H.Bilgi) (Prof.S.V. Chaudhari) (Prof.M.A.Chigteri)

Prepared By Secretary, PBOS Chairman, PBOS

Programme : Diploma in ET/CE/EE//ME/MT/CM/IT/DDGM

Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/16/17

Name of Course : Basic Electronics

Course Code : ET 281

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests, each of 60 minutes	3 hrs.	3 hrs.	--	--
Marks	20	80	50	--	25

Course Rationale:

Identify types of components and understand construction, working principle, specifications and applications.

Course Objectives:

After studying this course, the student will be able to
Identify types of components and understand construction, working principle ,
Specifications and applications.
Describe the formation of PN junction.
Draw the characteristics of basic components like diode, transistor etc.
Draw and describe the basic circuits of rectifier, filter, regulator and amplifiers.
Read the data sheets of diode and transistors
Explain construction, working, characteristics and applications of semiconductor devices and circuits.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Marks
1	**Passive Components**	16	18
	1.1 Resistor: • Classifications of resistors, material used for resistor. • General specification of resistor- maximum voltage rating, power rating, • Application of resistors. • Colour coding: with three, four & five bands • Potentiometer : linear and logarithmic • constructional diagram, specifications, applications of carbon and wire wound resistor		
	1.2 Capacitor : • Classification of capacitor, dielectric materials used in capacitor • Capacitor specifications: working voltage, capacitive reactance, frequency characteristic • Fixed capacitor : specifications & applications • Electrolytic capacitor: constructional diagram & working • Variable capacitors: requirement of variable capacitor, construction, working, specification of air gang, PVC gang capacitor, trimmer capacitor • Coding of capacitors using numerals, colour band system		
	1.3 Inductor: • Introduction of magnetic materials- Ferromagnetic & ferrimagnetic. • B-H curve, hard & soft magnetic material, concept of Hysteresis, permeability, • Faradays law of electromagnetic induction, self & mutual induced emf. • Induction – Definition & expression (with simple derivation) of self inductance, mutual inductance, coefficient of coupling, Q factor, inductive Reactance. • Constructional diagram & application of Air core, iron core & ferrite core,		
2	**Semiconductor Diodes**	16	20
	• **2.1 P.N. Junction Diodes** • Working principle & circuit diagram • characteristic of PN junction diode, • Specification, Static & dynamic resistance, forward voltage drop, maximum forward current power dissipation..		
	2.2 Zener diode • Symbol & Working principle • circuit diagram and characteristics of Zener diode • Specification: Zener voltage, power dissipation, dynamic resistance		
	2.3 Special Diodes • Construction, symbol & applications of • PIN diode • Schottky diode • Tunnel diode		

		2.4 Optical diodes • Construction, symbol, operating principle & applications of • LED, • LDR • Photodiode		
3		**Rectifiers and Filters**		
		3.1 Rectifiers • Need of rectifiers. Types of rectifiers : HWR,FWR (bridge and centre tap) circuit operation I/O waveforms for voltage & current • Parameters of rectifier (without derivation) Average DC value of current &voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier • Comparison of three types of rectifiers	**10**	**14**
		3.2 Filters • Need of filters • Circuit diagrams, operation and input-output waveforms of following types of filters • Shunt capacitor • Series inductor • LC filter • π filter		
4		**Wave shaping Circuit**		
		4.1 Linear wave shaping circuit • Need of wave shaping circuits, • comparison between linear and non-linear wave shaping circuits • Operations of wave shaping circuits • Linear circuits: RC Integrator & differentiator	**10**	**12**
		4.2 Non linear wave shaping circuits • Circuit diagram, operation, waveforms of different types of clippers using diodes: series, shunt, (biased and unbiased) • Circuit diagram, operation, waveforms of different types of clampers: positive and negative		
5	**Transistors**			
	5.1	**Bipolar junction transistor(BJT)** • Basic concept, • Types of transistors , • Structure & symbols Transistor operation, Conventional current flow. • Transistor configurations:- CB , CE & CC & their characteristics. • Transistor parameters- input resistance, output resistance, α, β & relation between them. Comparison between three configurations	**06**	**08**
6		**Regulators**		
	6.1	**Regulators** • What is regulator? • Need of regulators • voltage regulation factor • Concept of load regulation & line regulation • Basic zener diode voltage regulator	**06**	**08**
	6.2	**Linear Regulators**		

		• Basic block diagram of dc power supply • Transistorized series & shunt regulator – circuit diagram & operation. • Regulator IC's – 78xx, 79xx, 723 as fixed, variable & dual regulator. Pin diagrams , (only introduction)		
		Total	64	80

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment
1	Compute values of resistors by multimeter and colour coding
2	Identify & test fixed and variable capacitors.
3	Identify & test inductors 5 inductor of different types.
4	Verify the performance of LDR and to draw its characteristics
5	Identify & test IC's (analog & digital)
6	Forward & Reverse characteristics of diode (1N4001 , BY127, 1N4007)
7	Forward & Reverse characteristics of Zener diode
8	Zener as voltage regulator.
9	Study of Rectifiers a] Half wave b] Full wave (Center tapped & Bridge) (Waveforms, AC (r.m.s.) voltage at input, AC (r.m.s.) voltage at out put , D.C. output voltage, Ripple factor, PIV.)
10	Study of filter circuits. a] Capacitor Filter b] Inductor filter. (Using rectifier circuits. Measurement of Vac, Vdc)
11	Draw outputs for positive, negative and combinational clippers from C.R.O.
12	Draw the outputs waveforms of positive and negative clampers from C.R.O.
13	Plot frequency response of RC integrator and differentiator circuits.
14	Input & output characteristics of transistor in CB mode. (Measurement of α, α D.C. & R0)
15	Input & output characteristics of transistor in CE mode. (Measurement of β , β D.C. & R0)

Note: Any 10 Practical's from above list.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Passive Components	Classroom teaching and laboratory work.
2	Semiconductor Diodes	Classroom teaching and laboratory work.
3	Rectifiers and Filters	Classroom teaching and laboratory work.
4	Wave shaping Circuit	Classroom teaching and laboratory work.
5	Transistors	Classroom teaching and laboratory work.
6	Regulators	Classroom teaching and laboratory work.

Text Books:

Sr. No	Author	Title	Publication
1	R.S.Sedha	Applied Electronics.	
2	Albert Malvino.	Basic Electronics.	Tata McGraw Hill

3	B.L.Theraja.	Basic Electronics.	S.Chand.
4	N.N.Bhargava, D.C. Kulashreshtha, S.C. Gupta - TTTI	Basic Electronics & Linear Circuits	Tata McGraw Hill
5	Grob Bernard	Basic Electronics	Tata McGraw Hill
6	David J. Bell	Electronics Devices & Circuits	Prentice Hall of India

Reference Books:

Sr. No	Author	Title	Publication
1.	Mottershed	Electronics Devices and Circuits.	Prentice Hall of India
2.	Milmann Halkies	Electronics Devices and Circuits.	Tata McGraw Hill

Learning Resources: 1. Reference Books, 2. Data Manual

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Passive Components	06	06	02	14
2	Semiconductor Diodes	04	04	02	10
3	Rectifiers and Filters	06	04	02	12
4	Wave shaping Circuit	06	04	02	12
5	Transistors	06	04	02	12
6	Regulators	04	04	02	08
	Total	**38**	**28**	**12**	**80**

R.S.Deulkar. Deulkar

P.B.Dighule. –

Prepared By:

Prof. S.V.Chaudhari
Member Secretary, PBOS

Prof.C.Y.Totewar
Chairman, PBOS

Programme : Diploma in EE / ET

Programme Code : 02/22/16

Name of Course : Engineering Drawing

Course Code : ME 284

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**02**	**32**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	--	--
Marks	--	--	--	--	**50**

Course Rationale:

Engineering drawing is the graphical language. It is used by engineers, designers, planners, supervisors and also the workers to express their thoughts, ideas and concepts. The expression by drawing is very accurate, precise and brief. At a glance one can understand detailed description of any part to be manufactured or a dam to be built or an electric circuit to be used. For all technicians through understanding of principles of engineering drawing (Graphic Skills) is essential.

Course Objectives:

After studying this course, the student will be able to

- Draw various engineering curves.
- Incorporate Indian Standards in drawings.
- Sketch various orthographic and isometric views.
- Draw all different views from given components vis-à-vis.
- Draw free hand sketches.

Course Content:

Chapter No.	*Name of Topic/Sub topic*		Hrs	Weightage
1.	**Introduction of Drawing Instruments, Lines, Letters etc.**			
	1.1	Use of different drawing equipments.	02	--
	1.2	Type of letters.		
	1.3	Conventions of lines.		
	1.4	Scales.		
2.	**Engineering Curves and Tangential Exercises**			
	2.1	Geometrical constructions and tangential exercises.	04	--
	2.2	To draw an ellipse by concentric circle method.		
	2.3	To draw a parabola by : i) Directrixfocus method.		

	2.4	To draw a hyperbola by : i) Directrixfocus method.		
	2.5	To draw a cylndrical helix(limited to two turns)		
3.	**Orthographic Projections**			
		Introduction to orthographic projections first and third angle method of projection. Conversion of simple pictorial view, Dimensioning technique.	**10**	--
4.	**Sectional Orthographic Projections**			
		Introduction, converting the given pictorial view into sectional views.	**06**	--
5.	**Isometric Views**			
		Isometric scale and isometric views of simple objects.	**08**	--
		Isometric views of rectangular, cylindrical objects, Slots on sloping surface.		
6.	**Free Hand Sketches**			
		Fasteners, temporary threaded fasteners, locking arrangement, Foundation Bolts.	**02**	--
Total			**32**	--

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
Five sheets on topics covered in the syllabus.		
1.	Engineering curves and tangential exercises. Any four problems (Sheet No.2)	06
2.	Orthographic projection,TwoProblems (Sheet No.3)	08
3.	Sectional views. Two problems (Sheet No.4)	06
4.	Isometric projection. Minimum Two Problems. (Sheet No.5)	08
5.	Free hand sketches. Any Eight elements (Sheet No.6)	04
Total		**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to Drawing instruments lines letters etc.	Classroom teaching and Demonstration.
2.	Curves and tangential exercises	Demonstrations and classroom teaching.
3.	Orthographic projection	Use of models and classroom teaching.
4.	Sectional orthographic projection	Use of models, transparencies and classroom teaching.
5.	Isometric views	Classroom teaching, self study and assignments.
6.	Free hand sketches	Classroom teaching and assignments & use of Models.

NOTE : Term work evaluation on graphic skill.

Text Books:

Sr. No	Author	Title	Publication
1.	N.D. Bhatt	Elementary Engg. Drawing (Including plan and solid geometry)	Charotar Publication, Anand.
2.	Mali, Choudhary	Engineering Drawing	VrindaPrakashan, Jalgaon

Reference Books:

Sr. No	Author	Title	Publication
1	N.D. Bhatt	Geometrical and Machine Drawing	Charotar Publication, Anand.
2	--	I.S. 696 Latest version	B.I.S.
3	Curriculum Development Centre, TTTI, Bhopal	A Workbook in Engineering Drawing	Somaiyya Publication Pvt. Ltd., Mumbai
4	--	SP 46 – 1988	B.I.S.
5	G.R. Nagpal	Machine Drawing	--
6	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age International Publishers.

Learning Resources: Video cassettes No. 122, 123 of G.P.P. Library

Prof D.P.Khadse
Prepared By

Prof S.V.Chaudhari
Secretary, PBOS

Prof C.Y.Totewar
Chairman, PBOS

Programme : Diploma in Electrical Engineering

Programme Code : 02/16/22

Name of Course : Fundamentals Mechanical Engineering

Course Code : ME 285

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**02**	**32**
Practical	**02**	**32**

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	---	--	--	--	--
Marks	---	--	--	50	--

Course Objectives:

- Understand the construction and working of IC Engines, boilers, turbines and pumps.
- Understand the specifications of mechanical components and select the appropriate equipment.
- Understand the working of the basic refrigeration cycle and air conditioning systems
- Understand the function of various components used in industrial hydraulic circuits

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weight age
1.	**Boilers**			
	1.1	Introduction ,classification of boilers	05	--
	1.2	Fire Tube Boiler: Lancashire boiler, Cochron boiler, construction and working.		
	1.3	Water Tube Boiler: Babcock		
	1.4	Comparison of Fire Tube and water Tube		
	1.5	Boiler Mountings and Accessories: Definition and examples only		
	1.6	High pressure boilers: Lamount, Loeffler and Beson, construction and working		
2.	**Internal combustion engines**			

	2.1	Introduction, Classification of	04	--
	2.2	Four stroke cycle for petrol and diesel engine		
	2.3	Definitions of Indicated power, Brake power and efficiencies		
	2.5	Trouble shooting of IC engines		
3.	**Refrigeration and Air conditioning**			
	3.1	Definition of refrigeration, definition of	06	--
	3.2	Concept of COP, Refrigerating effect, Unit of Refrigeration.		
	3.3	Basic Components of Vapor compression systems (VCC) ,		
	3.4	Construction and working of a Refrigerator, Water cooler and a Ice-plant,		
	3.5	Construction and working of a Window air conditioner and split air conditioner		
	3.6	Layout of a central air conditioning system		
	3.7	LP/HP control, thermostats, overload protectors, relays.		
	3.8	Refrigerants used in various applications, Environmental issues of present refrigerants		
4.	**Turbines**			
	4.1	**Hydraulic turbines**: Layout of hydroelectric	05	--
	4.2	Construction and working of a Pelton turbine and Francis turbine.		
	4.3	Formulae for work done ,hydraulic eff., mechanical eff. and overall eff.		
	4.4	**Steam Turbines**: Layout of a steam power		
	4.5	Construction and working of a single stage impulse and reaction turbine		
5.	**Pumps**			
	5.1	Construction and working of a centrifugal Pump, type of casings, type of impellers, concept of priming	06	--
	5.3	Heads of a centrifugal pump, efficiencies of a		
	5.4	Simple numerical related to calculation of head, selection of a motor for the pump		
	5.5	Interpretation of performance characteristic curves (without referring to velocity diagram)		
	5.6	Specification of centrifugal pump, selection		
	5.7	Construction and working of a submersible		
6.	**Hydraulic and Pneumatic Components**			

	6.1	Elements of a Hydraulic and Pneumatic	06	--
	6.2	Oil reservoir,		
	6.3	Classification of Pumps, Classification of compressors, F.R.L. unit.		
	6.4	Pressure controls: Relief valve, Reducing valve Sequence valve.		
	6.5	Direction controls: Check valve, 2/2, 3/2, 4/2 direction control valve.		
	6.6	Flow controls : Classification ,symbols and		
	6.7	Actuators: Classification, application.		
	6.8	Symbols used hydraulic and pneumatic		
			32	--

List of Practical/Experiments/Assignments:

Sr.No	Name of practical/Experiment/Assignment	Hrs
1.	Demonstration of working of a 2 stroke and 4 stroke Petrol and diesel Engine	06
2	Construction and working of a Domestic Refrigerator	04
3	Construction and working of a Window Air conditioner	04
4	Construction and working of an Ice Plant	04
5	Demonstration of different Boilers	04
6	Visit to Workshop to observe the various machines like lathe, shaper etc.	06

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Boilers	Lectures, Q. A. Techniques
2.	Internal combustion Engines	Lectures, démonstration, laboratory work PPT présentation
3.	Refrigeration and Air-Conditioning	Lectures, démonstration, laboratory work PPT présentation
4.	Turbines	Lectures, démonstration, laboratory work PPT présentation
5.	Pumps	Lectures, démonstration, laboratory work PPT présentation
6.	Hydraulic and Pneumatic Components	Lectures, démonstration, laboratory work PPT présentation

Text Books:

Sr. No	Author	Title	Publication
1.	R. K. Rajput	Basic Mechanical Engineering	Laxmi Publications, New delhi

2.	P.K. Chadrashekar	Fluid Power(A Text Book of Hydraulics and Pneumatics)	Everest Publishing House, Pune

Reference Books:

Sr. No	Author	Title	Publication
1.	Patel Karam chandani	Heat Engines	Acharya Publication ,Vadodara Gujarat
2.	Jagdishlal	Hydraulic Machinery	Metropolitan Book Ltd., Delhi.
3.	R.S. Khurmi	Hydraulics and Hydraulic Machinery	S. Chand and Co. Ltd., Delhi.
4.	Hajra and Chaudhary	Workshop Technology vol-II	Media Promoter Pvt. Ltd., Mumbai.

Learning Resources: Class room teaching, Laboratory work, Reference book

(Prof. A.V.Joshi)
Prepared By

(Prof. S. V.Chaudhari)
Secretary, PBOS

(Prof. C.Y.Totewar)
Chairman,PBOS

Name of Programme	:	**Diploma in CE/EE/ET/ME/MT/CM/IT**
Programme Code	:	**01/16/22**
Name of Course	:	**Fundamentals Mechanical Engineering**
Course Code	:	**ME287**

GS2

TeachingScheme:-

	Hours/Week	Total Hours
Theory	02	32
Practical	02	32

EvaluationScheme :-

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	Two Class Tests each of 60 Minutes	03 Hrs.	---	---	32
Marks	20	80	---	---	0

CourseRationale:-

Electrical engineering is the basic engineering branch. Electric power supply is needed for running of mechanical equipment for which different electrical motors are used, so in mechanical industry, the electrical engineer has to take care of various electrical installations with its maintenance.

The electrical engineers has to look after various aspects related to electrical engineering in respect of mechanical equipment (Boiler, Turbine, Refrigeration and Air conditioning, pump).

There are the equipment that are used for generation of electric power. Electrical engineer has to play a key role in smooth functioning of mechanical industry.

CourseObjectives:-

	After studying this course the student will be able to
1	Know the function of different mechanical equipment along with their location.
2	Understand the construction and working of IC Engines, boilers, turbines and pumps.
3	Understand the working of the basic refrigeration cycle and air conditioning systems
4	Understand the function of various components used in industrial hydraulic circuits

CourseContents:-

Ch. No.		Name of Topic /Subtopic	Hrs	Weightage
1		**Boilers**	05	12
	1.1	Introduction, Classification of boilers		
	1.2	Fire Tube Boiler, Cochron boiler		
	1.3	Water Tube Boiler :- Babcock and Wilcox boiler, construction and working		
	1.4	Comparison of Fire Tube and water Tube boiler		
	1.5	Boiler Mountings and Accessories.		
	1.6	High pressure Boilers :- Lamont, and Loeffer, construction and working		
2		**Internal combustion engines**	04	12
	2.1	Introduction, Classification of I.C Engines, construction of I.C Engine, Its Terminology		
	2.2	Working of four stroke cycle petrol and diesel engine, Working of two stroke cycle petrol engine		
	2.3	Application of I.C engines		
	2.4	Comparison between two stroke and four stroke engine, Comparison between Petrol engine and Diesel engine		
3		**Refrigeration and Air conditioning**	06	14
	3.1	Definition of refrigeration, Type of refrigeration system, Application		
	3.2	Concept of COP, Refrigeration effect, Unit of Refrigeration, Refrigerant		
	3.3	Basic Components of Vapor compression refrigeration systems and its working		
	3.4	Construction and working of a Refrigerator, Water cooler and an Ice-plant,		

Elect. Engineering Deptt.
Government Polytechnic

	3.5	Construction and working of a Window air conditioner		
	3.6	Construction of split air conditioner, Advantages and disadvantages		
4		**Turbines**	05	12
	4.1	**Hydraulic turbines :** Classification		
	4.2	Construction and working of Impulse water turbine -Pelton turbine Construction and working of reaction turbine- Francis turbine		
	4.3	Comparison betweenImpulse water turbine and reaction turbine		
	4.4	**Steam Turbines :**Principle of operation of steam turbine		
	4.5	Construction and working of a single stage impulse and reaction turbine, comparison, Advantages and disadvantages of steam turbine		
5		**Pumps**	06	18
	5.1	Construction and working of a centrifugal Pumps, type of casings, type of impellers, concept of priming		
	5.2	Discharge of centrifugal pump, Heads of a centrifugal pump, Losses in centrifugal pump, Efficiency of centrifugal pump		
	5.3	Classification of pump, construction of reciprocating pump, working of single acting and Double acting reciprocating pump, application, Slip and cavitation		
	5.4	Comparison between reciprocating pump and centrifugal pump.		
6		**Hydraulic and Pneumatic Components**	06	12
	6.1	Elements of Hydraulic andPneumatic circuits		
	6.2	Classification, of Pumps, Classification of compressors, F.R.L. unit		
	6.3	Pressure controls: Relief valve, Reducing valve Sequence value.		
	6.4	Direction controls : Check valve, 2/2, 3/2, 4/2 direction control valve		
	6.5	Flow controls: Classification, Symbols and function.		
	6.6	Actuators : Classification, application		
	6.7	Symbols used hydraulic and pneumatic circuits.		
		Total	32	80

ListofPracticals/Experiments/Assignments:-

Sr. No.	Name of Practical / Experiment / Assignment	Hrs.
1	Demonstration of working of a 2 stroke and 4 stroke Petrol and diesel Engine	04
2	Construction and working of a Domestic Refrigerator	04
3	Construction and working of a Window Air Conditioner	04
4	Construction and working of an Ice Plat and water cooler	04
5	Study of pelton turbine and francis turbine.	04
6	Demonstration of different Boilers	04
7	Study of reciprocating pump and centrifugal pump.	04
8	Visit to Workshop to observe the various machines like lathe, shaper etc.	04
	Total	32

InstructionalStrategy:-

Sr. No.	Topic	Instructional Strategy
1	Biolers	Lectures, Q.A. Technicques
2	Internal combustion Engines	Lectures, demonstration, laboratory work PPT presentation
3	Refrigeration and Air conditioning	Lectures, demonstration, laboratory work PPT presentation
4	Turbines	Lectures, demonstration, laboratory work PPT presentation
5	Pumps	Lectures, demonstration, laboratory work PPT presentation
6	Hydraulic and Pneumatic Components	Lectures, demonstration, laboratory work PPT presentation

Text Books :-

Sr. No.	Author	Title	Publication
1	R. K. Rajput	Basic Mechanical Engineering	Laxmi Publications, New Delhi
2	P.K. Chadrashekar	Fluid Power (A Text Book of hydraulic and Pneumatics)	Everest Publishing House, Pune

ReferenceBooks :-

Sr. No.	Author	Title	Publication
1	Patel KaramChandani	Heat Engines	Acharya Publication, Vadodara Gujarat
2	Jagdishlal	Hydraulic Machinery	Metropolitan Book Ltd., Delhi.
3	R.S. Khurmi	Hydraulica s and Hydraulic Machinery	S.Chand and Co. Ltd. Delhi
4	Domkundwar V W	A course in Thermal Engg.	DhanpatRai& co.
5	R K Bansal	Fluid Mechanics & hydraulic Machine	Laxmi Publications, New Delhi

LearningResources :-Class room teaching, Laboratory work, Reference book

SpecificationTable :-

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Boilers	04	04	04	12
2	Internal combition Engines	04	04	04	12
3	Refrigeration and Air conditioning.	04	08	04	16
4	Turbine	04	04	04	12
5	Pump	04	08	04	16
6	Hydraulic and pneumatic components	04	04	04	12
	Total	**24**	**32**	**24**	**80**

(Prof. A.V Joshi) (Prof. S. V. Chaudhary) (Prof. M.S. Deshmukh)

Prepared By Secretary, PBOS Chairman, PBOS

Programme : Diploma in CE/ME/MT/EE
Programme Code : 01/04/05/21/24/15/18/19
Name of Course : Workshop Practice
Course Code : WS281

Teaching Scheme:

	Hours/Week	Total Hours
Theory	NIL	NIL
Practical	04	64

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	---	---	---	---	---
Marks	---	---	---	---	50

Course Rationale: To make the students conversant with the use of various workshop tools used in smithy, carpentry, fitting, welding ,plumbing and sheet metal shops.

Course Objectives:

After studying this course, the student will be able to

- Interpret the assigned job drawing.
- Identify various tools used in different shops of Work shop.
- Select appropriate tool set to perform a specific job.
- Acquire skills to use various tools.
- Take care and maintain the tools.
- Do practices in respective trades.
- Adopt safe practices during working.

List of Practicals/Experiments/Assignments:

Sr. No.	Name of topic/Subtopic	Hrs.
1	Demonstration of job involving minimum three operations. e.g. Upsetting, Drawing Down, Bending, Setting down.	08
2	One carpentry job involving carpentry joints and wood turning.	14
3	One fitting job involving Marking, Filing, Sawing, Drilling, Tapping.	14
4	One welding job involving welding joints.	14
5	One job in plumbing of pipe threading and pipe joints.	06
6	One job in sheet metal	08
	Total	**64**

Instructional Strategy :

Sr. No.	Topic	Instructional strategy
1	Smithy and forging	Explanation, Demonstration, exhibition of Models/Samples pieces.
2	Carpentry	
3	Fitting and filling	
4	Welding	
5	Plumbing	
6	Sheet Metal	

Reference Books :

Sr. No.	Author	Title	Publication
1	S. K. Hajara Chaudhari A.K. Hajara Chaudhari	Elements of Workshop Technology - Vol. I	Media Promoters and Publishers Pvt. Ltd., Mumbai-7
2	V. Kapoor	Workshop Practice Manual	Dhanpat Rai and Sons, New Delhi-32
3	B.S. Raghuwanshi	A course in Workshop Technology Vol.- I	Dhanpat Rai and Sons, New Delhi-32

Learning resources: Demonstration kit, charts, models/sample pieces and books.

Specification Table :

Sr. No	Topic	Knowledge	Imitation	Manipulation	Perfection	Total
1	Smithy and forging	5	---	---	---	5
2	Carpentry	3	2	3	2	10
3	Fitting and filling	3	2	3	2	10
4	Welding	3	2	3	2	10
5	Plumbing	3	2	3	2	10
6	Sheet Metal	5	---	---	---	5
	Total	**25**	**25**	**25**	**25**	**50**

Prepared By

(C. S. Ashtekar) Workshop Superintendent	(S. V. Chaudhari) Member Secretary, PBOS	(M. S. Deshmukh) Chairman, PBOS	(M.S.Satarkar) H.C.E.D. and Chairman, PBOS

Programme : Diploma in CE/EE/E&TC/ME/MT/CM/IT :
Programme Code 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Industrial Psychology
Course Code : HU281

Teaching Scheme :

	Hours/Week	Total Hours
Theory	02	32
Practical /Tutorial	01	16

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Three class tests of 60 min duration	3 Hrs	--	--	--
Marks	20	80	--	--	--

Course Rationale:

The overall purpose of the course is to acquaint with the major sub-areas within Industrial Psychology such as personality and temperament upon industrial psychology, psychology of management, impact of work environment upon the psychology of people in a workplace, psychology to recruitment, psychological testing ,motivation influences work productivity & psychological disorders or abnormalities

Course Objectives:

Maintain harmony among workers of various departments.
Understand needs and requirements of workers.
Extract maximum work with full cooperation and optimum efforts.
Proper assigning of the job as per workers capability.
Able to improve work culture of the organization, thus improving job satisfaction of the workers.

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Contents: Theory

Topic No.	Topic & Subtopic	Hours	Marks
1	**The Practice of Industrial Psychology** 1.1 Definition, objectives, scope, Principles, practices and problems, 1.2 Methods and techniques	**02**	**04**
2	**Understanding the Employee's Thinking** 2.1 Sensation and Perception, Thinking and Day Dreaming, Gestalt Approach, Unconscious and Conscious Psychic Elements, Explaining Behaviour, 2.2 Knowledge of Brain Processes, Personal Interpretation of a Given Situation, Instinct.	**06**	**14**
3	**Personality & Temperament** 3.1 Mature & immature temperaments (e.g. Sanguine, Melancholic, Choleric, Phlegmatic), emotional types, fear, intelligence, knowledge, deviation, etc	**04**	**08**
4	**Personnel Management** 4.1 Recruitment and selection, Psychological testing Performance appraisal, Training and development	**04**	**10**
5	**Organizational Psychology** 5.1 Leadership, Motivation, job satisfaction and job involvement, 5.2 Maslow's model of self actualization, Security, Money, Ambition, Companionship, Social reinforcement, Labor wastage, etc	**06**	**14**
6	**Work Psychology** 6.1 Working conditions - Noise, Space, Light Temperature, Speed of Work, etc. Accidents,	**04**	**10**

	Breakages, Fatigue etc. Safety, violence, and health in the workplace, Stress		
7	**Recruitment** 7.1 Ways of seeking applicants, types of interview, ways of selecting staff.	**04**	**10**
	Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr.No.	Name of Practical / Experiment/Assignment	Hrs
1	Assignment on Identifying similarities and differences that occur in	02
2	Assignment on the effect of personality and temperament upon	02
3	Assignment on Identifying applications for psychological testing in	02
4	Assignment on Identifying ways that the work environment might impact upon the psychology of people in a workplace	02
5	Assignment on the application of psychology to recruitment.	02
6	Assignment on the impact of social factors upon work productivity.	02
7	Assignment on the significance of psychological disorders or abnormalities in a workplace	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	The practice of Industrial Organizational psychology	Lecture method, Assignment discussion
2	Characteristics of work place	Lecture method, visit sho report
3	Development of Human Resources	Lecture method, case stud visit
4	Selection, psychological testing and training	Lecture method, discussion, visit case study
5	Engineering psychology	Lecture method, discussion, visit case study

Text Books:

Sr. No	Author	Title	Publicatio
1	Thomas Harrel.	Industrial Psychology	Khanna Publications
2	K.K.Ahuja	Industrial management and organizational behaviour	
3	R. D.Agrawal	Organization & Management	
4	O. P.Khanna	Production Technology Vol. I	Dhanpt rai and sons , II

Prepared by

C.Y.Totewar

Secretary, PBOS

A.S.Zanpure

Chiarman, PBOS

Mrs.M.A.Chigteri

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Name of Programme : **EE / ET / CM / IT**
Programme Code : **02/03/06/07**
Name of Course : **ENGINEERING MATHEMATICS III**
Course Code : **SC282**

Teaching Scheme:

	Hours / Week	Total Hours
Theory	02	32
Term work / Practical	01	16

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests of 60 min. duration	Hrs	--	--	--
Marks	20	80	--	--	--

Rationale:

- The student shall learn various techniques in integration and differential equations and use these techniques to their related Engineering problems.

Course Outcomes:

After completing this course students will be able to

1. Apply the definition of integration as inverse of differentiation to solve problems.
2. Apply various methods of integration..
3. Apply Mathematical principle to solve engineering problems.
4. Apply differential equation for solving problems in different engineering fields.
5. Apply the knowledge of Laplace transform to solve engineering problems.
6. Draw and come to a valid conclusion.
7. Locate the exceptional and critical points in an engineering system.

Course Contents: (Course Name: Engineering Mathematics III – SC282)

A. Theory :

Specific Learning Outcomes (Cognitive Domain)	Topics and subtopics	Hrs.
Units 1 : Integration		**10**
1.Define integration as anti derivative. 2. Integrate function using different method	1.1 Definitions, standard formulae, integration of algebraic sum of two or more functions, integration by substitutions and by trigonometric transformations, integration of $1/ax^2+bx+c$, $1/\sqrt{ax^2}+bx+c$, integration by parts, integration by partial fractions	
Unit 2: Definite integrals		**04**
1 Solve problems on definite integrals using the properties	2.1 Definition and properties of definite integrals Example based on these properties.	
Unit 3: Applications of integration		**04**
1. Find mean and R.M.S. value	3.1Mean value and root mean square value.	
Unit 4: Differential Equations		**05**
1. Define order and degree of differential equation 2. Solve the differential equation of first order and first degree 2. Solve different engineering problems using differential equation	4.2 Definition, order and degree of differential equations. Formation of differential equations. Solution of differential equations : (using following methods) i) Variable separable (ii) Reducible to variable separable. (iii) Homogeneous differential equations. (iv) Exact diff. equations. (v) Linear differential equations.	
Unit 5: Complex number		**05**
1.Define complex number 2. Define modulus ad amplitude 3.Solve examples on complex number using De Moivre's theorem 4.Find roots of complex number.	5.1Definition and algebra of a complex numbers. Geometrical representation (Argand's diagram), modulus and amplitude of a complex number. De Moivre's theorem (without proof), roots of complex number.	
Unit 6:Laplace Transform		**04**
1.Define Laplace transform, inverse transform , and Convolution theorem. 2. Solve examples on L.T. and Inverse L.T. 3.Solve differential equation using L.T.	6.1Definition, Laplace Transforms of elementary functions, important properties of Laplace Transforms, Inverse of Laplace Transforms, Convolution Theorem and application of Laplace Transform for solving differential equations.	
	Total Hrs.	**32**

(Course Name: Engineering Mathematics III – SC282)

B. List of Practicals /Laboratory Experiences/Assignments:

Practical No.	Specific Learning Outcomes (Psychomotor Domain)	Units	Hrs.
1.	Integration based on standard formulae.	Integration	1
2.	Integration by substitution method		1
3.	Integration on the type $1/ax^2+bx+c$, $1/\sqrt{ax^2}+ bx+c$,$1/asinx+bcosx+c$, $1/ asin^2 x +bcos^2 x +c$.		1
4.	Integration using By Part Rule and integration by partial fraction method.		1
5	Examples on Definite integral and it's properties	Definite integrals.	1
6.	Examples on Mean and R.M.S. value	Applications of integration	1
7.	Examples on order ,degree and formation of differential equation.	Differential Equation	1
8.	Solution of first order first degree D.E. using various methods.		1
9	Examples on algebra of complex number and determination of modulus and amplitude.	Complex Number	1
10	Examples on De Moivre's theorem and roots of complex number.		1
11	Examples on Laplace transform and inverse Laplace transform.	Laplace Transform	1
12	Examples on Convolution theorem and Solution of D.E. by Laplace transform.		1
	Skill Test		02
		Total Hrs.	**14**

Instructional Strategy:

Sr.No	Topic	Instructional Strategy
1	Integration	Class room teaching , chalk board
2	Definite integration	Class room teaching , chalk board
3	Applications of integration	Class room teaching , chalk board
4	Differential equation	Class room teaching , chalk board
5	Complex number	Class room teaching , chalk board
6	Laplace transform	Class room teaching , chalk board

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

(Course Name: Engineering Mathematics III – SC282)

Specification Table for Theory Paper:

Unit No.	Units	Levels from Cognition Process Dimension			Total Marks
		R	U	A	
01	Integration	08(04)	16(08)	00(00)	24(12)
02	Definite Integrals	04(04)	04(00)	00(00)	08(04)
03	Applications of integration	00(00)	00(00)	08(04)	08(04)
04	Differential Equation	04(00)	08(04)	04(04)	16(08)
05	Complex number	04(04)	04(02)	04(00)	12(06)
06	Laplace transform	04(02)	04(00)	04(04)	12(06)
	Total	**24(14)**	**36(18)**	**20(08)**	**80(40)**

R-Remember U – Understand A – Analyze / Apply

Question Paper Profile For Theory Paper:

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			option
	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	T	L	M	
01	1	R	4	1	R	4	1	U	4	1	U	4	1	U	4	1	U	4	**4/6**
02	1	U	4	2	R	4	2	R	4	2	U	4	3	A	4	3	A	4	**4/6**
03	4	R	4	4	U	4	4	U	4	4	U	4	4	A	4	4	A	4	**4/6**
04	5	R	4	5	R	4	5	R	4	6	A	4	6	A	4	6	A	4	**4/6**
05	1	R	2	1	R	2	1	U	2	1	U	2	3	A	2	3	A	2	**8/12**
	5	U	2	5	U	2	5	U	2	6	R	2	6	R	2	6	R	2	

T= Unit/Topic Number L= Level of Question M = Marks

R-Remember U-Understand A-Analyze/ Apply

(Course Name: Engineering Mathematics III – SC282)

Assessment and Evaluation Scheme:

	What		To Whom	Frequency	Max Marks	Min Marks	Evidence Collected	Course Outcomes
Direct Assessment Theory	CA (Continuous Assessment)	PT	Students	Two PT (average of two tests will be computed)	20	--	Test Answer sheets	1,2,3,4,5, 6,7
		Class Room Assignments		Assignments	--	--	Assignment Book	1,2,3,4,5, 6,7
				TOTAL	20			
	TEE (Term End Examination)	End Exam	Students	End Of the Course	**80**	**28**	Theory Answer sheets	1,2,3,4,5, 6,7
Direct Assessment Practical	CA (Continuous Assessment)	--	Students	--	--	--	--	--
		--		--	--	--	--	--
	TEE (Term End Examination)	--	Students	--	--	--	--	--
Indirect Assessment	Student Feedback on course		Students	After First PT	Student feed back form			
	End Of Course			End Of The Course	Questionnaires			

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

(Course Name: Engineering Mathematics III – SC282)

Scheme Of Practical Evaluation:

S.N.	Description	Max. Marks
1	Observations,	N.A.
2	Calculations and Result	N.A.
3	Viva voce	N.A.
	TOTAL	

Mapping Course Outcomes With Program Outcomes:

Course Outcomes	Program Outcomes (POs)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	3	3	2	1	1	1	1	3	1	2
2	3	3	2	1	1	1	1	2	1	2
3	3	2	3	2	1	1	2	2	1	3
4	3	2	3	2	1	1	2	2	1	3
5	3	2	3	2	1	1	2	2	1	3
6	3	2	2	1	1	1	2	2	2	1
7	2	2	2	1	1	1	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Reference & Text Books:

S.N.	Title	Author, Publisher, Edition and Year of publication	ISBN Number
1	Higher Engineering Mathematics	Khanna Publishers, New Delhi Grewal B.S	
2	Engineering Mathematics Vol.II	Satya Prakashan, New Delhi Vishwanath	
3	Mathematics for Polytechnic students	Pune Vidyarthi Griha Prakashan S.P. Deshpande	
4	Engineering Mathematics Part II	S. Chand & Co. Ltd. Delhi ,H.K. Dass	

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

List Of Experts & Teachers Who Contributed For This Curriculum:

S.N.	Name	Designation	Institute / Industry
1.		Chairman PBOS	
2.	Shri. V.B.Shinde	Faculty from Institute	Govt. Polytechnic ,Pune
3.		Faculty from Institute	
4.		Consultant from Industry	
5.		Faculty from nearby Institute	
6.		R.B.T.E.Representative	

(V.B.Shinde)
Prepared by

(A.S.Zanpure)
Member Secretary PBOS

(Mrs.M.A.Chigteri)
Chairman PBOS

Head. Engineering Deptt.
Government Polytechnic
Pune 411.016

	for transformer tank	3. Design of tank with tubes. 4. Numerical on Tank design.
Unit-4 Design of small single phase shell Type Transformers Hrs 06 Marks 08		
4.1	State the step by step procedure to design a single phase shell type transformer. Calculate overall dimensions and winding details of small single phase shell type transformer.	1. Introduction 2. Core design 3. Winding design 4. Windows area 5. Numerical on single phase shell type transformers.
SECTION-2		
Unit-5 Introduction to design of Induction Motors (3 phase, Squirrel Cage) Hrs 08 Marks 16		
5.1	State and explain the factors considered for designing three-phase induction motor.	1. Construction 2. Design consideration, specific loadings 3. Output equation 4. Choice of average flux density in the air gap 5. Choice of ampere conductors per meter 6. Efficiency and power factor 7. Main dimensions design (D & L) – Design Problem 8. Stator winding stator slots, stator core design, rotor design- Only concepts.(No numericals)
Unit-6 Introduction to design of single phase Induction Motors Hrs 08 (02) Marks 16		
6.1	State and elaborate the factors considered for designing single-phase induction motor.	1. Types of motors. 2. Starting characteristics 3. Construction 4. Output equation 5. Main dimensions 6. Relative size of single phase and three phase motors 7. Design of stator 8. Rotor design concept 9. Problems for the determination of main dimensions 10. Design of stator, rotor- Only concepts (No numerical)
Unit-7 Design of Magnet coils Hrs 08 (02) Marks 08		
7.1	Know the step by step procedure to design Magnet coils	1. Types of magnets 2. Construction of magnets 3. Design of magnet coil 4. current

LEVEL-III

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
EE381	Mini Project	--	2	--	2	--	--	25	25	--	50
EE382	Electrical Circuits and Networks	3	2	1	6	20	80	--	--	50	150
EE383	Electrical Measurements	3	2	--	5	20	80	--	--	50	150
EE384	Electrical Power Generation	3	2	--	5	20	80	--	50		150
EE385	Electrical Materials and Workshop	1	2	--	3	--	--	**25**	**25**	--	50
EE386	Computer Aided Electrical Drawing and Simulation	1	2	--	3	--	--	--	--	50	50
EE387	Electrical Machine - I	3	2	1	6	20	80	--	--	50	150
EE388	**Transmission and Distribution of Electrical Power**	**3**	**2**	--	**5**	**20**	**80**	--	**25**	--	**125**
EE389	**Instrumentation and Control**	**2**	**2**	**1**	**5**	**20**	**80**	--	**25**	--	**125**
ET390	Digital Electronics and Microprocessor	3	2	--	5	20	80	--	--	50	150

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Name of Programme : **Diploma in Electrical Engineering**

Programme Code : 02/16

Name of Course : **Mini Project (Individual)**

Course Code : **EE381**

Teaching Scheme:

	Hrs/Week	Total Hrs.
Theory	----	----
Term work / Practical	02	32
Total	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration		---	---	--	--
Marks	---	---	---	25	25

Course Aim:

Project work includes a range of design exercises, computing courses, industrial projects and build and test projects. For a technician knowledge of scientific problem solving and application of this knowledge to real life situations is very important. Project and Seminar helps him to develop this competence. It further helps him to develop professional skills such as making presentaqtions and report writing. The ability to carry out practical work and to present the results is obviously a key skill for all engineers to develop.

Course Objectives:

To develop the skill of problem identification and problem solving.

To develop the skill of searching information required for problem solving from number of sources.

To develop presentation and report writing skills.

Project work:

The student shall take up suitable project, preferably form the field of Electrical engineering. The project may be of the following nature.

- Design Exercise e.g. Wiring, Electronic circuits etc.
- Practical work, data collection its analysis and presentation.
- Or any other suitable topic approved by concern guide / HOD.

Submission of Project Report:

The student should submit a detailed report based on his/her mini project work. It should include relevant circuit diagrams, graphs, specification sheets, etc.

Format for the Project Report should be as follows:

- The report should be neatly typed on white A-4 size paper. The typing should be of normal spacing and only on one side of the paper.
- Project work approval sheet in the form of a certificate, duly signed, should be included.
- Suitable Font , Font size – Title – 14, Text – 12.
- The format of the text of the report should be as follows
  a) Index
  b) Synopsis or abstract
  c) Analytical & experimental work done
  d) Conclusions
  e) Bibliography
- The total number of typed pages should be about 15 to 25 (minimum)

(Mrs.U S Tulangekar)	(Prof. A.S.Zanpure)	(Mrs.M.A.Chigteri)
Prepared by:	Member Secretary	Chairman, PBOS

Programme : **Diploma in EE**

Programme Code : **02 / 16 / 22**

Name of Course : **Electrical Circuits and Networks**

Course Code : **EE 382**

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Tutorial	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	50	--	--

Course Rationale:

Most of electrical power generation, transmission, distribution and utilization are in the form of alternating current. Therefore it is essential for every electrical engineer to know the behavior of resistance, capacitance, inductance and related concepts in AC systems. This course intends to teach the student analysis of D.C. circuits using network theorems. It also covers the analysis of single phase, three phase circuit and transient analysis. This course is not only a prerequisite to learn the advanced electrical courses and develop the skills but also enable the students to apply the principle of ac circuits to troubleshoot electrical circuits in industries/Power System. This is one of the most important core engineering course for electrical engineers and hence students should try to develop mastery over concepts of AC circuits and network theorems for effective working as an electrical engineer.

Course Content:

	Major Learning Outcomes	**Topic and subtopics**
	Unit -1 Phasor Algebra (Review) Hrs 04 (01)Marks 04	
1.1	Explain the vector representation and of an alternating vector quantities.	• Symbolic notation of electrical quantity.
1.2	Represent an alternating quantity in polar and rectangular form	• Concept of polar and rectangular form of an alternating quantity and their utility.
1.3	What is an operator j ?Explain its Significance	• Significance of operator 'j'.
1.4	Convert the phasor given in rectangular form into polar form or	• Conversion of polar to rectangular and vice versa. (Numericals).

	vice versa	
1.5	Perform the operations like Addition, subtraction, Multiplication and division of vector quantity and express the result in rectangular and polar form.	• Addition, subtraction, Multiplication and division of vector quantity.
	Unit-2 Single Phase A.C. Series Circuits Hrs 08 (03) Marks 16	
2.1	Explain the behavior of AC voltage, current and power through pure resistance, pure inductance and pure capacitance with sketches.	• Basic concept of A.C. Circuit. • Derivation of expression for current. • Phasor diagram, wave form of voltage and current for Pure resistance (R),Pure inductance (L),pure Capacitor (C). • Average power consumed in pure inductive and pure capacitive circuit.
2.2	Explain behavior of AC voltage, Current and power through RL, RC and RLC series circuit with circuit diagram, phasor diagram and waveforms.	• Concept of Inductive and capacitive reactance, Impedance, power factor. • A.C .through R-L, R-C, and R-L-C series circuit. • Calculation of current, power and power factor. • Phasor diagram, waveform. • Impedance Triangle, Power Triangle.
2.3	Define resonance in RLC series and draw phasor diagram for resonance in RLC series circuit.	• Resonance of R-L-C series circuit. • Phasor diagram for resonanc in RLC series circuit.
2.4	Derive an expression of resonant frequency, Quality factor of series resonance circuit.	• Derivation of resonant frequency, Quality factor of series resonance circuit.
2.5	Draw the graphs showing variation of R, X_L, X_C,X, Z & I versus Frequency	• Graphical representation, effect of frequency on R,X_L, X_C, X , Z & I.
2.6	Solve numericals on resonanc in RLC series circuit	• Numericals.
	Unit-3 Single Phase A.C. Parallel Circuits Hrs 08 (03) Marks 12	
3.1	Define the terms admittance, susceptance and conductance and Calculation of current, power, power factor in R-L, RC,R-L-C parallel circuits using rectangular and polar methods.	• Concept of parallel circuit. • Concept of admittance, susceptance and conductance. • Calculation of current, power, power factor in R-L, RC,R-L-C parallel circuits using rectangular and polar methods.
3.2	Explain admittance method, phasor methods used to solve parallel , circuits.	• Use of admittance method, phasor method to solve parallel circuit.
3.3	Define resonance in parallel circuit and derive expression for resonant frequency, Quality factor	• Study of parallel resonance, Derivation of resonant frequency, quality factor.
3.4	Compare series and parallel resonance circuits	• Comparison of series and parallel resonance.
3.5	Solve numericals on resonanc in parallel circuit	• Numericals
	Unit-4 Poly-phase A.C. Circuits Hrs 08 (02) Marks 14	
4.1	State the Advantages of 3 phase system over 1 phase system.	• Advantages of 3 phase system over 1 phase system for the transfer of same power.
4.2	Describe the principle of 3-phase emf generation and draw its waveform and phasor diagram	• Principle of 3-phase emf generation and its waveform, and phasor diagram.

4.3	Define phase sequence for polyphase system and state possible phase sequences for three phase system.	• Concept of phase sequence ,symmetrical system and balanced load. • Possible phase sequences for three phase system.
4.4	Explain types of interconnections of three phase systems	• Star Connection system and delta connection systems- Connection diagram advantages, disadvantages and applications of each types.
4.5	State and derive relationship between line and phase quantities for star and delta connection.	• Relation between phase and line current, phase and line voltage in Star connected and Delta connected balanced system. • Phasor diagram. • Calculation of current, power, power factor in a 3 Phase balanced load (Numericals).
Unit-5 D.C. / A.C. Circuits and Theorems Hrs 18 (06) Marks 28		
5.1	Define electric network and its types and define source, load.	• Definitions- Source, Load, Unilateral and Bilateral circuits. Linear and Non Linear circuits.
5.2	Convert the given Voltage source into Current source and Current source to Voltage source	• Source conversion.
5.3	State, explain and apply different laws and theorems for analyzing d.c. circuits.	• Statement, Explanation and application of following laws and theorems for given DC/AC circuits and numericals. a) Kirchhoff's current law b) Kirchhoff's voltage law c) Mesh / Loop analysis d) Nodal Analysis e) Superposition Theorem f) Thevenin's Theorem g) Norton's Theorem h) Star Delta Transformation • Simple numericals.
5.4	Apply theorems to AC circuits	• Application of superposition theorem only to AC circuit.
Unit-6 Transients (DC) Hrs 02 (01) Marks 06		
6.1	State the expression for rise of current and decay of current for R-L series circuit	• Transients in R-L and R-C series circuits. • Concept of current growth and decay and time constant in R-L series circuits. (No derivation (expressions only and simple numericals on it)
6.2	State the expression for charging of voltage and discharging of voltage for R-C series circuit	• Charging and dischrging of Capacitor through R-C series circuit. No derivation (expressions only and simple numericals on it)
6.3	Define Time constants of R-L series and R-C series circuits	• Time constants of R-L series and R-C series circuits

Note :- 1.Teaching hrs in the bracket indicates tutorial Hrs.

2. Weightage of Marks:-30%Theory 70% Numericals

List of Practicals/Experiments/Assignments:

Sr. No	Name of practical/Experiment/Assignment	HRS
1.	To observe the response of pure R, pure L and pure C on CRO	02
2	To find resistance and inductance of choke coil.	02

3.	To find current and p.f. in R-C-Series circuit	
4	Draw a phasor diagram of R-L-C series circuit for following conditions, a) Lagging P.F. b) Leading P.F. c) Unity P.F.	02
5.	Draw a phasor diagram of R-L and R-C parallel circuit & determine P.F. circuit current, & power.	02
6.	Perform resonance of parallel circuit & determine P.F & circuit current.	02
7	Relationship between line voltage and phase voltage and line current and phase current in case of star connection and Delta connection.	02
8	Verification of KCL and KVL	02
9	Verification of superposition Theorem	02
10	Verification of Thevenin's Theorem	02
11	Verification of Norton's Theorem.	02
12	Verification of Star – Delta transformation	02
13	To plot charging and discharging curve of R-C series circuit.	02

Note:-Minimum TEN practicals from above list at list one on each topic to be performed in the laboratory.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Phasor Algebra (Review)	Lecture, Method, Chalk Board technique
2.	Single phase A.C. Series circuits	Lecture, Q/A technique
3.	Single Phase A.C. Parallel Circuits	Lecture, Q/A technique
4.	Polyphase A.C. Circuits	Lecture Method, Q/A technique
5.	D.C. / A.C. Circuits and Theorems	Lecture Method, Q/A, technique
6.	Transients (DC)	Lecture Method; Q/A, technique

Text Books:

Sr. No	Author	Title	Publication
1.	B.L. Theraja	Electrical Technology Vol I and II	S.Chand and Co., New Delhi
2.	V. N. Mittle	Basic Electrical Engineering	Tata McGraw Hill

Reference Books:

Sr. No	Author	Title	Publication
1.	Jain and Jain	ABC of Electrical Engineering	Dhanpat Rai Publishing Company
2.	Edvard Hughes	Electrical Technology	Pearson Education.
3.	H.Cotton	Electrical Technology	CBC, Delhi

Learning Resources: Books, Models, Charts and Drawings.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Phasor Algebra (Review)	02	01	01	04
2	Single phase A.C. Series circuits	04	06	06	16
3	Single Phase A.C. Parallel Circuits	03	03	06	12
4	Polyphase A.C. Circuits	04	04	06	14
5	D.C. / A.C. Circuits and Theorems	06	06	16	28
6	Transients (DC)	02	02	02	06
	Total	**21**	**22**	**37**	**80**

(Prof.J.D.Naik)
Prepared By

(S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Measurement

Course Code : EE 383

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	3 hrs	3 Hrs	---	---
Marks	20	80	50	--	--

Course Rationale:

Accurate and Precise measurement of the quantities such as voltage, current, power, etc. is essential to Operate and maintain the electrical machines and systems effectively and efficiently. Instruments are the devices which are used to measure such parameters. The electrical diploma engineer should therefore be competent to use, calibrate and maintain different types of electrical measurement systems and instruments used in the industry and power systems. This demands a better understanding of the construction, material used and principle of operation of various types of measuring instruments. This course is therefore designed to meet these needs and hence it is a core course for any electrical engineer.

Course Contents:

UNIT-1 Fundamentals of Measurements HRS -04 Marks 08		
Major learning outcome		**Topic and subtopics**
1.1	Describe the necessity of measurement and Instruments	• Need of measurement and Instruments.
1.2	State the different qualities of instruments and define the terms sensitivity, accuracy, Precision, reliability, stability.	• Qualities of instruments: sensitivity, accuracy, Precision, reliability, stability.
1.3	Differentiate between direct and indirect methods of measurement.	• Methods of measurement -Direct and indirect.
1.4	Give the classification of instruments and discriminate between Indicating, integrating and recording, absolute and secondary instrument.	• Classification of instruments based on :- a) Limits of percentage error. b) Principles of operation (or Electrical effect used) c) Nature of operation (or output) – indicating, recording and integrating type, d) absolute and secondary instrument. • Instruments class (Standard and sub-standard instruments)
1.5	Differentiate between deflecting, controlling and damping torques.	• Essential torque of indicating instruments:-Deflecting, Controlling and damping torques
1.6	Different types of errors with examples.	• Types of errors

UNIT-2 Ammeter and Voltmeter HRS -06 Marks 10		
2.1	Explain the Working of Galvanometer.	• Review of construction & principle of Galvanometer (PMMC Type).
2.2	State the different types of Ammeter and Voltmeter and explain the principle of operation, construction, merits and demerits of each type of meter.	• Types of Ammeter and Voltmeter :- MI, PMMC & dynamo type • Construction, principle of operation merits and demerits of above type of meters.
2.3	Differentiate between different types of ammeter and voltmeter	• Differentiate between different types of ammeter and voltmeter
2.4	Descrbe the conversion of galvanometer to ammeter and voltmeter	• Conversion of galvanometer to ammeter using shunt. • Conversion of galvanometer to voltmeter using multiplier.
2.5	Illustrate the use of shunts and multipliers for range extension of ammeter and voltmeter.	• Extension of range of Voltmeter and ammeter using multiplier & shunt respectively
2.6	To carry out Calibration of ammeter and voltmeter.	• Calibration of Ammeter & voltmeter using potentiometer.
UNIT-3 Measurement of resistance HRS -04 Marks 08		
3.1	Classify different types of Resistances.	• Classification of electrical resistance based on magnitude range as low, medium & high.
3.2	Explain the procedure to measure low resistance.	• Method and procedure used for measurement of low resistance using Kelvin's double Bridge .
3.3	Explain the procedure and different methods used to measure medium resistance	• Methods and procedure used for measurement of medium resistance using . a) Whetstone's bridge. b) Ammeter-voltmeter method. c) Ohmmeter
3.4	Draw the block diagram of digital multimeter and state its Advantages and Applications.	• Digital Multimeter:-Block Diagram, Advantages and Applications.
3.5	What is Megger? and how measurement of high resistance is carried out using Megger.	• Measurement of high resistance using Megger.
3.6	Explain the Measurement of earth resistance using earth tester	• Measurement of earth resistance using earth tester.
UNIT-4 Measurement of Inductance and Capacitance HRS -05 Marks 08		
4.1	Select an A.C. bridge to Determine inductance and capacitance and explain their working.	• Measurement of Inductance and capacitance using a)Maxwell's Inductance Bridge b) Anderson's bridge c) Schering Bridge • Precautions & limitations of A.C. bridge (No derivation No phasor Diagram) only formula & simple numericals.
UNIT-5 Instrument Transformer HRS -04 Marks 06		
5.1	Illustrate the use of an Instrument transformer like C.T and P.T for extension range of meters	• C.T. & P.T. – Construction, types & requirement. • Terminology of CT & PT such as ratio, burden & phase angle. • Precautions to be taken in their use.

		• Specification & Classes of C.T. & P.T. • Advantages of I.T.over shunt and multiplier.
5.2	Describe the construction & working of Clamp on meter	• Clamp on meter –construction & working.
UNIT-6 Measurement of Power HRS -08 Marks 14		
6.1	Explain the use of dynamometer type wattmeter.	• Principle of operation, construction of dynamometer type wattmeter. • Low P.F. Wattmeter (Electrodynamometer type) and its use.
6.2	Determine the Error due to pressure coil connections	• Error due to pressure coil connections
6.3	Carry out Calibration of wattmeter.	• Procedure for Calibration of wattmeter
6.4	Select the appropriate method for measurement of power in three-phase circuit.	• Construction and operation of poly phase watt-meter. • Measurement of active & reactive power in three phase circuits for balanced and unbalanced loads using Two wattmeter method calculation of p.f. from wattmeter readings, effect of p.f. on watt meter readings. • Measurement of active &reactive power in three phase balanced load by using one wattmeter method. • Measurement of power using C.T & P.T.
UNIT-7 Measurement of Electrical Energy HRS -09 Marks 14		
7.1	Describe the construction and working of single phase and three phase energy meter (Induction Type)	• Principle of operation & Construction of single phase and three-phase induction type energy meter. • Errors and their correction.
7.2	Carry out calibration of Energy meter	• Procedure for Calibration of energy meter as per I.S.
7.3	Know the recent trends in energy meters	• Digital Energy meter and Tri-vector meter.
7.4	Procedure of energy meter testing	• Testing of energy meter (induction and digital energy meter) as per I.S.
UNIT-8 Special Measuring Instruments HRS -08 Marks 12		
8.1	Know the special measuring Instruments	• Construction and working principle of, single phase electrodynamometer type P.F. meter. • Construction & working principle of electrical resonance type p.f. meter. • Weston type synchroscope. • L.C.R. Meter. • Phase sequence indicator-Static type and rotating type. • Frequency meter (Weston &Ferro dynamic type)

List of Practicals/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	Hrs
1	Symbols used for identifying different types of analog instruments.	02
2.	Disassemble the MI & PMMC type instruments & show the different parts of instruments. Also write functions & materials used for the same.	02
3	Calibration of Ammeter and Voltmeter	02
4. a) b)	Measurement of Resistance, Voltage, Current in A.C & D. C. Circuit by using digital multimeter. Measurement of A.C. Current by Clip-on ammeter (Tong Tester).	02
5.	Measurement of Medium resistance by Whetstone's bridge or Kelvin's double bridge.	02
6.	Measurement of Earth Resistance by Earth Tester.	02
7.	Measurement of Insulation Resistance by Megger.	02
8.	Extension range of meters using CT/PT.	02
9.	Measurement of active and reactive power in three phase balanced load by single wattmeter method.	02
10.	Measurement of active and reactive power in three phase balanced load by two wattmeter method and observe the effect of Power Factor variation on Wattmeter reading.	02
11.	Calibration of Energy meter at various power factors & load as per IS with standard energy meter or wattmeter & stopwatch.	02
12.	Connection & calibration of CT operated three phase electronic energy meter.(with CT & without CT)	02
13.	Measurement of power factor of single phase and three phase load by PF meter and verifying through I, V and P measurement.	02
14.	Measurement of Circuit Parameters by LCR meter.	02
15	Observe the phase sequence of three phase circuit Using phase Sequence Indicator.	02

Note:-Minimum TEN practicals from above list at list, one on each topic to be performed in the laboratory.

Instructional Statergy:

Sr. No.	Topic	Instructional Strategy
1	Fundamentals of Measurements	Lectures,Q.A.Techniques
2	Ammeter and Voltmeter	Lectures,demonstration,laboratory work,PPT presentation
3	Measurement of resistance	Lectures,demonstration,laboratory work,PPT presentation
4	Measurement of Inductance and Capacitance	Lectures,demonstration,laboratory work,PPT presentation
5	Instrument Transformer	Lectures,demonstration,laboratory work,PPT presentation
6	Measurement of Power	Lectures,demonstration,laboratory work,PPT presentation
7	Measurement of Electrical Energy	Lectures,demonstration,laboratory work,PPT presentation
8	Special Measuring Instruments	Lectures,demonstration,laboratory work,PPT presentation

Text Books:

Sr. No.	Author	Title	Publication
1.	A.K.Sowhney	A Course in Electrical Engineering	Dhanpat rai and

		measurement and Instrumentation	Co.Pvt.Ltd.Delhi

Reference Books:

Sr. No.	Author	Title	Publication
1.	E.W .Golding and F.C.Widdis	Electrical measurement and Measuring Instruments	Wheeler publishing,Allahabad
2.	N.V.Suryanaraya na	Electrical measurement and Measuring Instruments	Tata McGraw-Hill Publishing Company Ltd.

Learning Recourses:

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's
6. Models 7. Experimentation 8. Diagram Demonstration

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Fundamentals of Measurements	04	02	02	08
2	Ammeter and Voltmeter	04	02	04	10
3	Measurement of resistance	02	02	04	08
4	Measurement of Inductance and Capacitance	02	04	02	08
5	Instrument Transformer	02	02	02	06
6	Measurement of Power	04	04	06	14
7	Measurement of Electrical Energy	04	06	04	14
8	Special Measuring Instruments	04	04	04	12
	Total	**26**	**26**	**28**	**80**

(Prof.J.D.Naik, Prof.M.H.Bilgi)
Prepared By

(Prof. S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Power Generation

Course Code : EE 384

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	01	16

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs	--	--	---
Marks	20	80	--	25	--

Course Rationale:

Generation of electrical power is the heart of electrical power system. With growing demand for electric power at one hand and depleting fossil fuel resources it has become more necessary to generate electric power more efficiently and with the help of renewal energy resources. With advancement in technology it has become possible to generate electric power commercially using wind and solar energy. It is necessary to understand the constructional details, working and performance of different power stations such as Thermal (Coal), Hydro, Nuclear, Diesel, gas and other renewal energy sources. This course deals with the basic knowledge required to take appropriate decisions to maintain the various generating and auxiliary equipment of power plants. It covers the safety precautions required to be followed by the engineering diploma holders in various power plants.

Course Contents:

Sr. No.	Major learning outcome	Topic and subtopics
		UNIT-1 Introduction HRS -02 Marks-04
1.1	List the various sources of Energy and give comparison between them.	• Importance of Electrical Energy. • Sources of Energy: conventional and renewable • Comparison of Energy Sources. • Types of fuels: solid, liquid and gaseous, their calorific values, advantages and disadvantages of these fuels. Overview of electrical power Generation in Maharashtra and future perspectives.
		UNIT-2 Thermal Power Station HRS -12 Marks-14
2.1	State the factors governing selection of site for Thermal station.	Factors governing selection of site for Thermal station.
2.2	Draw the block diagram of thermal power plant and explain the function of each block.	Constituents of steam power plant and their function. • Schematic block diagram of Thermal power plant. • Coal handling unit (Various stages in coal handling unit). • Boiler (Fire tube and water tube boilers). • Super-heater and re-heater • Steam prime movers (turbines). • Condensers • Spray ponds and cooling towers. Turbo alternator (salient features).

2.3	Describe the Flue gas flow diagram of thermal Power plant with function of each part	Flue gas flow diagram of thermal Power plant with function of each part • Draught Systems: Natural draught, Mechanical draught, Forced, induced and balanced draught: definition and working only • Economizer • Feed water heater • Ash precipitators.
2.4	State the best practices to be compiled with TPS	• Best Practices of TPS regarding operation and maintenance, safety and health and environment.
2.5	State Major TPS in Maharashtra with their generating capacities	• Major TPS in Maharashtra with their generating capacities.
2.6	Enlist the advantages and disadvantages of Thermal power stations	• Advantages and disadvantages of Thermal power stations.
	UNIT-3 Hydro Power Station Hrs-08 Marks-12	
3.1	State the factors governing selection of site for Hydro Electric power plant.	• Factors governing selection of site for Hydro Electric power plant.
3.2	Define the terms and explain their significance in capacity of power plant	• Definition of the terms and their significance in capacity of power plant: Hydrology, surface Runoff, Evaporation and precipitation.
3.2	Give the classification of Hydro Electric power plants with respect to water flow regulation, load, to head, Pumped Storage Power Plant	Classification of Hydro Electric power plants: • According to water flow regulation • According to load. • According to head. • Pumped Storage Power Plant
3.3	Draw the schematic block diagram of hydro electric power plant and explain the function of each block.	Schematic arrangement of Hydro Electric Power Plant and function of Elements listed below: • Storage Reservoir, Dam, Forebay, Spillway, Surge tank, Penstock, Trash rack, Tail Race, Prime movers or water turbines. • Types of hydro turbines: Reaction and Impulse • Comparison between Francis and Kaplan turbine. • Governing of turbines. • Salient features of Hydro generator.
3.4	Name the major HPS in Maharashtra with their capacities	• Hydro power stations in Maharashtra with their generating capacities.
3.5	State advantages and disadvantages of hydro power station.	• Advantages of Hydro Power Plants and their effect on ecology/environment.
	UNIT-4 - Nuclear Power Stations HRS -06 Marks-12	
4.1	Define the terms Radioactive isotopes,mass energy equivalence, binding energy and mass defect, nuclear chain reaction, multiplication factor, critical size.	A brief review of atomic physics • Radioactive isotopes, mass energy equivalence, binding energy and mass defect, nuclear chain reaction, multiplication factor, critical size. • Nuclear Fuels
4.2	State the factors governing Selection of site for the nuclear power plant	Factors governing Selection of site for the nuclear power plant
4.3	Explain working of nuclear power station with schematic arrangement.	• Schematic arrangement of Nuclear Power Plant. • Main parts of reactors and their Function: Nuclear fuels, reactor core, moderator, shielding, control rods, reflectors,

		coolant, and reactor vessel.
4.4	Describe various types of reactors.	• Classification of nuclear reactors: operation and constructional features: • Gas Cooled Reactor (GCR) • Boiling Water Reactor (BWR) • Pressurized water reactor (PWR) • Fast Breeder Reactor (FBR)
4.5	How disposal of Nuclear waste is carried out and describe Nuclear Shielding.	• Disposal of Nuclear waste and Nuclear Shielding.
4.6	Name the major NPS in Maharashtra with their capacities.	• Nuclear power stations in Maharashtra with their generating capacities.
4.7	State advantages and disadvantage of NPS.	• Advantages and disadvantages of Nuclear Power Station.
UNIT-5 – Diesel and Gas Turbine Power Stations HRS -08 Marks-14		
5.1	Draw layout of a medium size Diesel Electric Power Plant and identify Elements of diesel Electric Power Plant and write their functions	• Layout of a medium size Diesel Electric Power Plant, • Elements of diesel Electric Power Plant With their functions: • Diesel engine, Fuel system, Air Intake System, Exhaust system, cooling system, lubrication system, Engine Starting system.
5.2	Enlist the advantages, disadvantages and Applications of diesel power plants	• Applications of diesel power plants. • Advantages and disadvantages of Diesel Electric Power Plant.
5.3	Describe Captive Power Generation with their different types	• Captive Power Generation • Types of captive power plants. • Advantages and disadvantages of Captive Power Plant.
5.4	What is Co-generation and Distributed power generation.	• Co-generation • Distributed power generation.
5.5	Draw the layout of Gas turbine power plant	• Layout of Gas turbine power plant.
5.6	State the factors governing selection of site, Advantages and disadvantages of Gas Turbine Power Plant.	• Factors governing selection of site. • Types of fuels • Advantages and disadvantages of Gas Turbine Power Plant.
5.7	State Major Gas turbine power plants in Maharashtra with their generating capacities	• Major Gas turbine power plants in Maharashtra with their generating capacities.
UNIT-06 Performance of Power Stations HRS-08,Marks-16		
6.1	Explain the factors affecting economics of power generation.	• Factors affecting economics of power generation,
6.2	Explain the importance of load curve and load duration curve .	• Load curve and load duration curve • Importance of high load factor and diversity factor choice of size and number of generator units for a given load Curve and operation schedule (Numerical).

6.3	Define the terms connected load, maximum demand, Demand factor, Average load ,load factor, diversity factor ,capacity factor , utilization factor.	• Average demand, maximum demand, Demand factor, diversity factor, load factor, plant capacity factor, utilization factor (Numerical)
6.3	Differentiate between base load and peak load power plants	• Base load and peak load power stations – meaning, types, and comparison. • Combined operation of power stations.
	UNIT-07-Interconnected Power System HRS-04 Marks-08	
7.1	Explain the concept of grid and advantages & disadvantages of interconnected Power system.	• Inter connection of power stations at state and national and international (State and National grid). • Advantages and disadvantages of interconnected system. • Function of Load dispatch centre.
7.2	Explain operation and control of interconnected power stations.	• Operation and control of interconnected power system.
7.3	Explain the working of Load dispatch centre (LDC)	• Function of Load dispatch centre.
7.4	Define smart grid and describe its working.	• Concept and working of smart grid.

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
01	Draw layout of Thermal Power Station (T.P.S.) & explain the working of T. P. S.	02
02	Prepare technical report of visit to a nearby T.P.S./Prepare a report on thermal power stations in Maharashtra by collecting data from Internet.	02
03	Draw layout of Hydro Power Station (H.P.S.) and state the function of each component.	02
04	Prepare technical report of visit to a nearby H.P.S./Prepare a report on Hydro power stations in Maharashtra by collecting data from Internet.	02
05	Draw the schematic diagram of Nuclear power station & state the function of each component.	02
06	Prepare technical report of visit to a nearby Diesel Power Plant.	02
07	Collect the data from nearest sub-station and draw the load curve.	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction	Lectures, discussion
2	Thermal Power Station	Lectures, discussion, PPT
3	Hydro Power Station	Lectures, discussion, PPT
4	Nuclear Power Stations	Lectures, discussion ,PPT
5	Diesel and Gas Turbine Power Stations	Lectures, discussion, PPT
6	Performance of Power Stations	Lectures, discussion
7	Interconnected Power System	Lectures, discussion

Text Books:

Sr. No.	Title	Author	Publication
1	Principles of Power System	V.K.Mehata	S.ChandCo. , Delhi
2	Course of Electrical Power system	Soni,Gupta Bhatnagar	Dhanpat Rai and Son's., Delhi

Reference Books:

Sr. No.	Title	Author	Publication
1	Electric Power	S.L.Uppal	Khanna Publisher, Delhi.

Learning Recourses:

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's
6. Models 7. Experimentation 8. Diagram Demonstration

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Introduction	02	02	00	04
2	Thermal Power Station	06	04	04	14
3	Hydro Power Station	04	04	04	12
4	Nuclear Power Stations	04	04	04	12
5	Diesel and Gas Turbine Power Stations	06	04	04	14
6	Performance of Power Stations	04	04	08	16
7	Interconnected Power System	02	04	02	08
	Total	**28**	**26**	**26**	**80**

(Prof.K.M.Kakade Prof.J.D.Naik, Prof.V.L.Munde)
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Materials and Workshop

Course Code : EE385 (GS1)

Teaching Scheme:

	Hours/Week	Total Hours
Theory	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	–	–	–	–	–
Marks	–	–	–	–	50

Course Rationale:

The diploma electrical engineering students are required to perform tasks such as selection of proper material for manufacturing of any electrical goods or to repair it, selection of different types of wires, cables, switches etc. relevant to the current, voltage ratings and applications. Such skills can be developed through the electrical workshop practices which will be useful in industries for using various electrical tools, measuring instruments, safety tools and devices. This course is designed in such a way that practicals performed in this course will develop these basic skills to perform well in the industry.

Course Contents:

UNIT-I Introduction to Electrical Engineering Materials.HRS -02		
Major learning outcome		**Topic and subtopics**
1.1	To know the various materials used in the field of electrical engineering.	• Classification of materials –conductor, insulator, semi-conductor, magnetic material.
UNIT-II Conducting Materials and its Properties.HRS -05		
2.1	To know the various conducting and resistive materials and their characteristics and applications with their TRADE names	• Low resistive conductor, copper, copper-zinc alloys, cadmium-Copper alloy, chromium-Copper alloy, , Reinforced copper. • Bronze. • Aluminum and aluminum alloys, steel-cored Aluminum. • Galvanized iron steel. • Low resistance material-solders, contacts, Classification of contact materials, important alloys for contacts in various electrical equipments, sintered material. • Materials of low conductivity. • Materials used in making a. Precision electrical measuring instruments, b. Standard resistors, c. Resistance elements for rheostats and similar control devices, d. Carbon, construction of carbon elements depending on the requirements as per use. • Applications and Trade names of above materials, Code of practice,

		• Use of IS for conducting materials.
2.2	State the different properties of Conducting material	• Resistivity, effect of temperature, impurities, stress on resistivity of conductor, Requirements of High/Low conducting Material.
2.3	Understand the concept of super conducting Materials & its use.	• concept of super conducting Materials • Use of super conducting materials for various engineering Applications.
UNIT-III Insulating Materials and its Properties.HRS -04		
3.1	To know the various insulating material and their characteristics and applications with their TRADE names.	• Gases dielectrics-Air, Nitrogen, sulphur hexafluoride. • Liquid dielectric of Petroleum insulating oils, a. Insulating oils for transformers and Switchgears. b. Solid insulating materials classification c. Fibrous materials impregnating coating, d. Filling and bonding materials. • Resins: Synthetic and natural, varnishes, impregnated fibrous material, Stock plastics, molding, compounds. • Electrical insulating films, Rubber, Mica and mica base materials. • Ceramic materials, porcelain, Glasses: Glass bonded mica, Classes of insulating materials and their temperature limits as per IS. • Applications and Trade names of above materials, Code of practice.
3.2	State the different properties Insulating material	• Electrical properties-Volume resistivity, break down voltage, dielectric strength/constants. • Mechanical properties. • Thermal properties. • Chemical properties and physical properties. • Insulation Classes. • Electrical conductivity of gases, liquid, solid dielectrics.
UNIT-IV- Magnetic Materials and its Properties HRS -02		
4.1	To know the various Magnetic material and their applications.	• Classification:-Diamagnetic Materials, Paramagnetic Materials, Ferromagnetic Materials, ferrite materials. Soft and hard magnetic materials.
4.2	State the different properties Magnetic material	• Introduction, Spontaneous magnetization curve and Hysteresis loop. • Effect of temperature, frequency on magnetization curve. • Curie-Weiss law.
UNIT-V- Special Purpose Materials HRS -02		
5.1	To know the Special Purpose materials and their applications.	• Properties of materials used in following. • Thermocouple, bimetallic • Fuses Material, • Varistors, • Thermostats • Thermister
UNIT-VI- Principle, Procedure and Selection of Material HRS -01		
6.1	To know the Selection criteria of material for particular applications.	• Principle of selection of material for particular application.

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
01	Testing of D.C. supply , A.C. single phase and Three phase supply by different methods note down the observations.	02
02	To Create awareness about safety precautions while working on electrical appliances / installations in form of Dos & Don'ts • General safety precautions and related IE Rules. • Importance of safety devices such as Hand gloves, gumboot, mats etc. • Importance electrical live safety devices such as earthing, ELCB & MCB.	02
03	To demonstrate the use of following tools & meters: Pliers, nose prier, cutter, screw driver, tester, test lamp etc. Ammeter, voltmeter, wattmeter, clip on ammeter, Multimeter & Megger. Various tools required for electrical wiring & electrical work and their use.	04
04	To make wire joints and cable termination by using different tools. • T joint on multi Twist joint • Married joint • code wire. • Britannia joints • Single core termination • Fixing lugs & crimping • Termination by screw	04
05	To Carry out Market Survey for technical specification, commercial name,cost & purpose of following different types wiring accessories: 1. Switches. 2. Lamp holders. 3. Ceiling roses 4. Mounting blocks. 5. Socket outlets. 6. Plugs. 7. Wooden/ ply / modular boards of different sizes. 8. Main switches (ICDP and ICTP) & MCB. 9. Junction box. 10.Distribution fuse boards, 11.Bus-bar for lighting & small power circuits.	04
06	Collect the samples following cables & wires and determine the specifications of each of them. Also state their use. • Single core cable & multi core cable. • Standard wires :-single strand wire, multi strand wire, shielded wire. • Weather proof cables & Flexible wires.	02
07	A) To draw & make connections of following control circuits. • Tube light • Stair case wiring • Godown wiring • Distribution board for one lamp, one fan & 1/2 sockets. • Lamps for street light(any one lamp for 5-6 students of group) 1. Sodium vapour lamp. 2. Mercury vapour lamp. 3. LED lamps. • Lamps for decoration purpose. • Energy saving lamps. B) To carry out the wiring of above circuits in following wiring methods. • Casing-capping wiring	08

	• PVC conduit wiring • Arrange visit or video to show the concealed wiring technique. • comparison of various wiring systems.	
08	To dismantling & Assembling of the different home appliances and determine their specifications. • Automatic electric iron • Heater • Geyser • Bell • mixer / food processor.	04
09	To soldering of electrical and electronic components on general purpose PCB for any application.	02
	Total	32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction to Electrical Engineering Materials	Lecture ,discussion,Q/A
2	Conducting Material and its Properties	Lecture, discussion, Q/A
3	Insulating Materials and its Properties	Lecture ,discussion,Q/A
4	Magnetic Materials and its Properties	Lecture, discussion, Q/A
5	Special Purpose Materials	Lecture ,discussion,Q/A
6	General Safety Precautions and Safety	Lecture, discussion, Q/A
7	Principle, Procedure and Selection of Material	Lecture ,discussion,Q/A

Text Books:

Sr. No	Author	Title	Publication
1	S.L. Uppal	Electrical Wiring Estimating and Costing	Khanna Publication, Delhi
2	Surjit Singh	Electrical Estimating & Costing	Dhanpat rai & co. Delhi

Reference Books:

Sr. No	Author	Title	Publication
1	A.J. Dekker	Electrical Engineering materials	Prentice Hall of India Pvt. Ltd.,Delhi
2	Indulkar S.	Electrical Engineering materials	Chand Publication, Delhi
3	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Delhi.

Learning Recourses :

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's
6. Models 7. Experimentation 8. Diagram Demonstration

(Prof.K.M.Kakade,Prof.J.D.Naik)
Prepared By

(S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Materials and Workshop

Course Code : EE390 (GS2 Path)

Teaching Scheme:

	Hours/Week	Total Hours
Theory	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	30 Minutes	--	--	---	---
Marks	10 *	40 *	--	25 **	25 **

Note- * Material portion, ** Workshop portion

Course Rationale:

The diploma electrical engineering students are required to perform tasks such as selection of proper material for manufacturing of any electrical goods or to repair it, selection of different types of wires, cables, switches etc. relevant to the current, voltage ratings and applications. Such skills can be developed through the electrical workshop practices which will be useful in industries for using various electrical tools, measuring instruments, safety tools and devices. This course is designed in such a way that practicals performed in this course will develop these basic skills to perform well in the industry.

Course Contents:

	Major learning outcome	Topic and subtopics
UNIT-1 Introduction to Electrical Engineering Materials.HRS -02		
1.1	To know the various materials used in the field of electrical engineering.	• Classification of materials –conductor, insulator, semi-conductor, magnetic material.
UNIT-2 Conducting Materials and its Properties.HRS -05		
2.1	To know the various conducting and resistive materials and their characteristics and applications with their TRADE names	• Low resistive conductor, copper, copper-zinc alloys, cadmium-Copper alloy, chromium-Copper alloy, , Reinforced copper. • Bronze. • Aluminum and aluminum alloys, steel-cored Aluminum. • Galvanized iron steel. • Low resistance material-solders, contacts, Classification of contact materials, important alloys for contacts in various electrical equipments, sintered material. • Materials of low conductivity. • Materials used in making a. Precision electrical measuring instruments, b. Standard resistors, c. Resistance elements for rheostats and

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

		similar control devices, d. Carbon, construction of carbon elements depending on the requirements as per use. • Applications and Trade names of above materials, Code of practice, • Use of IS for conducting materials.
2.2	State the different properties of Conducting material	• Resistivity, effect of temperature, impurities, stress on resistivity of conductor, Requirements of High/Low conducting Material.
2.3	Understand the concept of super conducting Materials & its use.	• concept of super conducting Materials • Use of super conducting materials for various engineering Applications.
	UNIT-3 Insulating Materials and its Properties.HRS -05	10 + 2
3.1	To know the various insulating material and their characteristics and applications with their TRADE names.	• Gases dielectrics-Air, Nitrogen, sulphur hexafluoride. • Liquid dielectric of Petroleum insulating oils, a. Insulating oils for transformers and Switchgears. b. Solid insulating materials classification c. Fibrous materials impregnating coating, d. Filling and bonding materials. • Resins: Synthetic and natural, varnishes, impregnated fibrous material, Stock plastics, molding, compounds. • Electrical insulating films, Rubber, Mica and mica base materials. • Ceramic materials, porcelain, Glasses: Glass bonded mica, Classes of insulating materials and their temperature limits as per IS. • Applications and Trade names of above materials, Code of practice.
3.2	State the different properties Insulating material	• Electrical properties-Volume resistivity, break down voltage, dielectric strength/constants. • Mechanical properties. • Thermal properties. • Chemical properties and physical properties. • Insulation Classes. • Electrical conductivity of gases, liquid, solid dielectrics.
	UNIT-4 Magnetic Materials and its Properties HRS -02	07
4.1	To know the various Magnetic material and their applications.	• Classification:-Diamagnetic Materials, Paramagnetic Materials, Ferromagnetic Materials, ferrite materials. Soft and hard magnetic materials.
4.2	State the different properties Magnetic material	• Introduction, Spontaneous magnetization curve and Hysteresis loop. • Effect of temperature, frequency on magnetization curve. • Curie-Weiss law.
	UNIT-5 Special Purpose Materials HRS -02	06
5.1	To know the Special Purpose materials and their applications.	• Properties of materials used in following. • Thermocouple, bimetallic • Fuses Material, • Varistors, • Thermostats • Thermister
	UNIT-6 Principle, Procedure and Selection of Material HRS -01	
6.1	To know the Selection criteria of material for particular applications.	• Principle of selection of material for particular application.

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
01	Testing of D.C. supply , A.C. single phase and Three phase supply by different methods note down the observations.	02
02	To Create awareness about safety precautions while working on electrical appliances / installations in form of Dos & Don'ts • General safety precautions and related IE Rules. • Importance of safety devices such as Hand gloves, gumboot, mats etc. • Importance electrical live safety devices such as earthing, ELCB & MCB.	02
03	To demonstrate the use of following tools & meters: Pliers, nose prier, cutter, screw driver, tester, test lamp etc. Ammeter, voltmeter, wattmeter, clip on ammeter, Multimeter & Megger. Various tools required for electrical wiring & electrical work and their use.	04
04	To make wire joints and cable termination by using different tools. • T joint on multi Twist joint • Married joint • code wire. • Britannia joints • Single core termination • Fixing lugs & crimping • Termination by screw	04
05	To Carry out Market Survey for technical specification, commercial name,cost & purpose of following different types wiring accessories: 1. Switches. 2. Lamp holders. 3. Ceiling roses 4. Mounting blocks. 5. Socket outlets. 6. Plugs. 7. Wooden/ ply / modular boards of different sizes. 8. Main switches (ICDP and ICTP) & MCB. 9. Junction box. 10.Distribution fuse boards, 11.Bus-bar for lighting & small power circuits.	04
06	Collect the samples following cables & wires and determine the specifications of each of them. Also state their use. • Single core cable & multi core cable. • Standard wires :-single strand wire, multi strand wire, shielded wire. • Weather proof cables & Flexible wires.	02
07	A) To draw & make connections of following control circuits. • Tube light • Stair case wiring • Godown wiring • Distribution board for one lamp, one fan & 1/2 sockets. • Lamps for street light(any one lamp for 5-6 students of group) 1. Sodium vapour lamp. 2. Mercury vapour lamp. 3. LED lamps. • Lamps for decoration purpose. • Energy saving lamps.	08

	B) To carry out the wiring of above circuits in following wiring methods. • Casing-capping wiring • PVC conduit wiring • Arrange visit or video to show the concealed wiring technique. • comparison of various wiring systems.	
08	To dismantling & Assembling of the different home appliances and determine their specifications. • Automatic electric iron • Heater • Geyser • Bell • mixer / food processor.	04
09	To soldering of electrical and electronic components on general purpose PCB for any application.	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction to Electrical Engineering Materials	Lecture ,discussion,Q/A
2	Conducting Material and its Properties	Lecture, discussion, Q/A
3	Insulating Materials and its Properties	Lecture ,discussion,Q/A
4	Magnetic Materials and its Properties	Lecture, discussion, Q/A
5	Special Purpose Materials	Lecture ,discussion,Q/A
6	Principle, Procedure and Selection of Material	Lecture ,discussion,Q/A

Text Books:

Sr. No	Author	Title	Publication
1	S.L. Uppal	Electrical Wiring Estimating and Costing	Khanna Publication, Delhi
2	Surjit Singh	Electrical Estimating & Costing	Dhanpat rai & co. Delhi

Reference Books:

Sr. No	Author	Title	Publication
1	A.J. Pakkar	Electrical Engineering materials	Prentice Hall of India Pvt. Ltd.,Delhi
2	Indulkar S.	Electrical Engineering materials	Chand Publication, Delhi
3	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Delhi.

Learning Recourses :

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's
6. Models 7. Experimentation 8. Diagram Demonstration

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Computer Aided Electrical Drawing and Modelling

Course Code : EE 386

Teaching Scheme:

	Hours/Week	Total Hours
Theory	00	00
Tutorial	00	00
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	--	--	Three Hrs	--	---
Marks	--	--	50	--	--

Course Rationale:

In any commercial, power and industrial sector the drawing of their manufactured equipment, their installation, operation and maintenance is required. To work in such industries a technician must possess the skill of reading, interpreting different drawings and simulating electrical and electronics circuit for most of the activities. With the evolution of various computer software's the role of earlier draftsman is now taken over by Computer software. The Computer Aided Drawing (CAD) and simulation software's like PSpice, Electronic workbench or any other similar software is included in this course. It is also helpful for better understanding of various concepts already studied by the students in earlier courses.

Course Objectives:

- Draw and edit different shapes in Autocad.
- Draw general graphical symbols and notations used in Electrical engineering using CAD software.
- Draw various electrical circuits using CAD Software.
- Draw the cross sectional view of various electrical machines using CAD software.
- Draw plant layout/single line diagram using CAD software.
- Draw various electronics circuits using Auto CAD electrical and Electronics software.
- List the steps of using simulation software in Electrical engineering.
- State the procedure to build simple simulation circuits.
- Build, simulate and test simple electric circuits.
- State the procedure to build circuits of verification of n/w theorems.

List of Practicals:

Sr. No.	Tutorial/Exercise	Hrs. Required
01	Demonstration of use of AutoCad	02
02	Draw electrical and electronic symbol using CAD and take print out. (Switch, Three pole switch, lamp, Resistance, Inductance, Capacitance, Transformer, Diode,Zener Diode, Transistor(PNP,NPN), Gates:AND,OR,NOT,NOR,NAND,Ex-OR)	02
03	Draw a circuit of verification of Ohm's law	02
04	Draw RLC series circuit.	
05	Draw D.C.Machine parts using CAD	
06	Draw Layout of power plant and single line diagram of substation using CAD.	02
07	Draw bridge rectifier circuit using CAD	02
08	Demonstration of use of simulation software	02
09	Study of verification of Ohm's Law	02
10	Study the response of R-L-C series circuit.	02
11	Study the response of V-I Characteristics of Diode.	02
12	Study the response of half wave and Full wave rectifier.	02
13	Verification of Superposition theorem	02
14	Study the Charging of capacitor through resistance.	02

Note: All 14 practicals are to be performed.

Text Books:

Sr. No.	Title	Author	Publication
1	Electrical Technology Vol. I and II	B.L. Theraja	S.Chand and Co., New Delhi

Learning Recourses: Computer lab, Simulation software.

(Prof.C.Y.Totewar)
Prepared By

(Prof.S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Machine-I

Course Code : EE 387

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Tutorial	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs	--	--	---
Marks	20	80	50	--	--

Course Rationale:-

This subject belongs to core technology group which intends to teach facts, concepts, principles & procedure for operation of electrical machines, such as DC generators, DC motors and single & three phase transformers.
These machines are used for transmission, distribution & utilization systems. Knowledge gained by the students will be helpful in the study of technological subjects such as Utilization of electrical energy, switch gear & protection, manufacturing processes & testing & maintenance of electrical machines.
The knowledge & the skills obtained will be helpful while performing the duties such as Supervisor, controller & technician.

Course Contents:

UNIT-1 D.C.Generator HRS -10 + (02 T) Marks-10		
Major learning outcome		Topic and subtopics
1.1	Describe function of different parts of DC machine with sketches.	• Construction of DC machine. • Different Material used for various parts of DC machine. • Functions of various parts of DC machine.
1.2	Differentiate between the types of armature.	• Simplex lap winding and wave winding & their related terms.
1.3	Explain the working of DC Generator.	• D.C. Generator: - Working principle.
1.4	Derive emf equation of DC generator.	• E.M.F Equation.
1.5	Classify different types of DC Generators with schematic diagram	• Types of generator :-Series, Shunt, Compound
1.6	Describe performance characteristics of different types of DC Generators.	• Characteristics of generators, • Applications of each type.
1.7	Describe the methods to determine the losses and efficiency of dc generator.	• Concept of losses in dc machine. • Power stages • Efficiency & condition for maximum efficiency.
1.8	Explain Armature reaction and commutation	• Armature reaction and its effect. • Methods to minimize armature reaction.

		• Commutation
UNIT-2 D.C.Motor HRS -10 +(04 T) Marks-16		
2.1	Explain working of DC motor & compare it with generator.	• Working principle of DC Motor . • Comparison of generator & motor action of dc machine.
2.2	State the significance of back emf & derive its equation.	• Back emf Equation:- Significance & Derivation.
2.3	Derive power and torque equation of DC motor.	• Power, Torque, shaft torque equations.
2.4	Justify the need of DC motor starter and explain its working.	• Necessity of starter . • Working of Three point starter.
2.5	Classify different types of DC motor.	• Types of DC Motors:-Series, Shunt and Compound DC Motor.
2.6	Compare performance of different types of DC motors	• Performance characteristics of DC Series, Shunt and Compound Motor.
2.7	Explain the speed control of DC motor	• Speed control of d.c. series and shunt motor.
2.8	Calculate the losses and efficiency of dc motor.	• Losses in DC motors and its computation. • Efficiency
2.9	List the applications of various types of DC motors.	• Applications of DC Series, Shunt and compound motor.
UNIT-3 Single Phase Transformer Hrs-14 +(06 T) Marks-32		
3.1	Explain the function of various parts single phase transformer and working of a single phase transformer.	• Construction, function & materials used for different parts of Single phase transformer • Working principle of Single phase transformer.
3.2	Differentiate between core and shell type transformer with sketches.	• Types of Transformer:-Core and shell type of transformers.
3.3	Derive EMF equation of transformer and transformation ratio.	• EMF equation and transformation ratio.
3.4	Draw and explain the phasor diagram of ideal transformer and practical transformer on no load & load.	• Concept of ideal Transformer and practical transformer. • Transformer on no-load with phasor diagram. • Transformer with different types of load(resistive, inductive and capacitive loads) with Phasor diagram.
3.5	State the various losses in transformer.	• Losses in transformer: Iron loss, Copper loss.
3.6	Derive expression for efficiency and the condition for maximum efficiency of a single phase transformer	• Efficiency:- Definitions of Commercial Efficiency, All day Efficiency • Expression for efficiency and the condition for maximum efficiency of a single phase transformer.
3.7	Describe the significance of voltage regulation and its calculation with per unit resistance, per unit reactance.	• Voltage regulation: Definition, computation of voltage regulation for different types of loads. • Per unit resistance, per unit reactance, per unit impedance and percentage impedance.
3.8	State the need for conducting different types of tests on single phase transformers.	• Different types of tests and their necessity:- Direct load test, OC and SC test and Sumpner test along with connection diagrams to calculate efficiency and regulation of transformer.
3.9	Draw the equivalent circuit of a single phase transformer and determine the various parameters of equivalent circuit from OC /SC test	• Equivalent circuit of single phase transformer. • Determine Parameters of equivalent circuit of transformer from OC /SC test.
3.10	Describe working of an autotransformer with sketches.	• Construction and working of an autotransformer. • Copper saving.

3.11	Distinguish between an autotransformer and two winding transformer.	• Distinguish between autotransformer and two winding transformer.
UNIT-4 – Three Phase Transformer HRS -08 +(02 T) Marks-12		
4.1	Describe function of different parts of Three Phase Transformer	• Construction of 3 phase transformer : Main tank, bushings, conservator, breather, oil level gauge, radiators, buchholz's relay, explosion vent, temperature indicators, junction box.
4.2	Explain the working of a three phase transformer with sketches	• Working principle of three phase transformer.
4.3	Compare 3 phase transformer with a bank of 3 single phase transformers.	• Comparison between three phase transformer and bank of 3 single phase transformers.
4.4	Describe the significance of windings connection of three phase transformer with vector group.	• Windings connections of 3 phase transformer. • Voltage & current ratios, vector group for above connections. • Open delta connection.
4.5	Aware the recent trends in transformer construction.	• Recent trends in transformer construction like amorphous core, dry type transformer, Hermetically Sealed transformer.
4.6	Use and functioning of on-load Tap-Changer	• On-load Tap-Changer
UNIT-5 Parallel Operation of Transformers HRS -06 + (02 T) Marks-10		
5.1	State the need and condition for parallel operation of single phase and three phase transformers.	• Need of Parallel Operation of single phase transformer and three phase transformer. • Condition of Parallel Operation of single phase transformer and three phase transformer.
5.2	Explaind the parallel operation & determine the load sharing of single phase and three phase transformer.	• Parallel operation and load sharing of single phase and three phase transformer with phasor diagram. • Numericals on equal voltage ratios only.

List of Practical's:

Sr. No.	Tutorial/Exercise	Hrs. Required
01	To identify the constructional parts of D. C. machine with their function & material used.	02
02	To plot the O.C.C. of a given d. c. machine and to find critical resistance	02
03	To control the speed of d. c. shunt motor above and below normal speed.	02
	Performance the brake test on dc series motor & determine efficiency.	04
05	a) Sheet showing constructional parts of three-phase transformer. b) Visit to maintenance and repair workshop or manufacturing of a transformer and prepare a report.	04
06	To carry out direct load test on single phase transformer and determination of efficiency and regulations.	02
07	To perform O.C. and S.C. test on single phase transformer and calculate efficiency, regulation and draw equivalent circuit of transformer.	06
08	a)To carry out different connections of three phases transformer and determine voltage & current ratio. b) Perform the load test on delta /star connected transformer.	04
09	To observe the phase difference between primary & secondary voltage of 3-phase Transformer for various vector groups.	04
10	Perform the parallel operation of two single phase transformers and observe load sharing by each transformer (theoretical & practical).	04

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	D.C. machine	Lecture method with B/B & PPT, Lab work & Demonstration of machine parts.
2	D.C. Motor.	Lecture method with B/B & PPT, Lab work & Demonstration of machine parts.
3	Single phase transformer	Lecture method with B/B & PPT, Lab work
4	Three phase transformer	Lecture method with B/B & PPT, Lab work ,Visit to industry/SS.
5	Parallel Operation of Transformer	Lecture method with B/B & PPT, Lab work

Text Books:

Sr. No.	Title	Author	Publication
1	Electrical Technology Vol. II	B.L. Theraja	S.Chand and Co., New Delhi
2	Principles of Electrical Machines	Mehta	
3	Electrical Machine-I	J. B. Gupta	S. K. Kataria & sons, New Delhi,

Reference Books:

Sr. No.	Title	Author	Publication
1	Electrical Machines	Despande, M.V.	PHI Learning,, New Delhi, 2011 or
2	Electrical Technology	Uppal, S.L.	Khanna Publication, New Delhi,
3	Electrical Machine	Nagrath, I.J. and	Tata McGraw Hill, New Delhi, 2011

Learning Recourses :

Class room, Machine Laboratory, PPT presentation, Text books & reference books, Industrial Visit.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	D.C. Generator	02	04	04	10
2	DC Motor	04	06	06	16
3	Single phase transformer	08	12	12	32
4	Three phase Transformer	04	04	04	12
5	Parallel Operation of Transformers	02	04	04	10
6	**Total**	**20**	**30**	**30**	**80**

(Prof.J.D.Naik, Prof.V.L.Munde)
Prepared By

(S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Programme : Diploma in EE

Programme Code : 02 / 16 / 22

Name of Course : Transmission and Distribution of Electrical Energy

Course Code : EE 388

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	3 hrs	--	--	--
Marks	20	80	--	25	--

Course Rationale:

Generated electrical power has to pass through various stages before being utilized by the consumer. Diploma technicians have to deal with various aspects of transmission and distribution system. They should be well conversant with materials required and the methods employed for erection and maintenance of the same.

Course Content:

	Unit: 1 Basics of Transmission Hrs 06 Marks 12	
	Major Learning Outcomes	**Topic and subtopics**
1.1	State the features of different transmission systems. State the advantages and disadvantages of AC and DC transmission. Compare overhead and underground systems.	• A.C.and D.C. transmission systems: features, comparison between A.C. and D.C. transmission. • Primary and Secondary transmission. • Overhead and Underground transmission systems: features, Comparison between Overhead and Underground transmission systems.
1.2	Classify the lines based on their length and voltage rating	• Transmission line classification based on length of transmission line and voltage level.
1.3	State the advantages and disadvantages of EHV AC transmission.	• Advantages and disadvantages of using high voltages for transmission of electric power.
	Unit: 2 Components of Transmission Line Hrs 16 Marks 24	
2.1	Identify the main components of Transmission line	• Different components of transmission lines: a. Conductors b. Overhead line supports – poles, (Wooden, RCC and Steel poles) c. Towers d. Cross arm e. Stay sets f. Ground wire g. Lightning Arrestors h. Fuses and isolating switches e. Insulators (pin, suspension , shackle, strain type)

2.2	State the features of different types of conductors. State the advantages of stranded and bundled conductors.	• Types of conductors and their features: Copper, Aluminium, ACSR, Solid, Stranded and Bundled conductors.
2.3	State the features of different types of line supports.	• Types of line supports: wooden poles, steel poles, R.C.C poles, steel towers (single circuit and double circuit).
2.4	State the need and function of different transmission line components	• Need and function of following transmission line components - Cross arm, Stay sets, Ground wire, Lightning arrestors, Fuses and isolating switches.
2.5	State the features of different types of insulators.	Line insulators: • Requirements • Types:- pin, suspension , shackle, strain type
2.6	State the causes of failure of insulators.	• Causes of failure of insulators.
2.7	Derive the expression for string efficiency for a string of three insulators.	• Potential distribution over a string of disc
2.8	Solve simple numerical problems on string efficiency.	• Numerical on string efficiency
2.9	Explain the methods of improving the string efficiency.	• String efficiency and methods of improving string efficiency.
2.10	Explain the criteria for spacing of Conductors. Explain the meaning of span and sag. State the factors on which sag depends.	• Spacing between conductors, span length • Concept of sag (No Numerical).
2.11	State the need of underground cables. Explain the construction of cable with a neat sketch.	• Requirement of underground cables • General construction of cable.
2.12	State the classification of cables based on voltage rating and number of cores.	• Classifications of cable • Cable specifications
Unit: 3 Performance Of Transmission Lines Hrs 10 Marks 16		
3.1	Explain the effects of R, L and C on 1-ph and 3-ph transmission line.	• Concept of transmission line parameters like R,L,C (no formulae or numerical)
3.2	Explain skin effect, proximity effect, Ferranti effect, corona and transposition of transmission line. State the advantages and disadvantages of corona. State the methods of minimizing corona.	• Skin effect • Proximity effect • Ferranti effect • Transposition of 3-phase lines. • Corona – Formation of corona, advantages and disadvantages, methods of minimizing effects of corona.
3.3	Define efficiency and regulation of transmission line. Solve simple numerical problems on efficiency and regulation of transmission line.	• Losses, Efficiency and Regulation of short transmission line (numerical).
3.4	Differentiate the features of the short, medium and long transmission lines. Draw and explain the 'T' and 'TT' model for medium transmission line.	Features of medium transmission lines, and their equivalent circuits (end condenser method, nominal 'T' and 'TT' method (no numerical).
Unit: 4 Distribution System Components Hrs 10 Marks 16		
4.1	State the need for distribution system.	• Necessity of distribution system, Primary and secondary distribution.

4.2	Describe with sketches the various connection schemes of the distribution system.	• Types of distribution systems • AC distribution and its requirements, connection schemes of distribution system: Ring, Radial etc.,
4.3	Solve simple numerical problems on voltage drop calculation of feeder fed at one end.	• Voltage drop calculations for feeder fed at one end.
4.4	State the causes of low power factor and disadvantages of low power factor	• Causes of low power factor • Disadvantages of low power factor
4.5	State the advantages of improved power factor and explain the methods to improve it. Solve simple numerical problems on power factor improvement.	• Advantages of improved power factor • Methods of improving power factor - By use of i) Static condenser ii) Synchronous condensers.iii) Automatic p.f. Improvement iv) Phase advancers (Numerical)
Unit: 5 Sub-Station Hrs 06 Marks 12		
5.1	State the need for electrical substations. Classify sub-stations based on service requirements and construction. Compare Indoor and Outdoor sub-stations.	• Classification of Sub-Stations: according to service requirement, according to constructional features. • Comparison between indoor and outdoor substations.
5.2	Sketch the symbols for sub-station equipment. State the need and function of sub-station equipment.	• Symbols for equipment in sub-stations. • Equipment in transformer sub-stations: Bus-bars, Insulators, Isolators, Circuit breakers, Power transformers, Instrument transformers, Metering and indicating instruments, Carrier current equipment, Batteries.
5.3	Explain different bus-bar arrangements.	• Bus bar arrangement: Single bus-bar system, Duplicate bus-bar system.
5.4	Draw single line diagram of typical transformer sub-station.	• Single line diagram of typical transformer sub-station.

List of Practical/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	HRS
1.	Drawing sheet On interconnected grid system of power supply of Maharashtra state.	04
2.	Drawing sheet on transmission line components in proportional dimensions.	02
3.	Prepare a report on different types of insulators used in transmission system with their specifications.	04
4.	To perform an experiment to calculate string efficiency.	02
5.	To perform an experiment to find efficiency and regulation of a short transmission line.	02
6.	Prepare a report about types of cables used in distribution system by visiting nearby cable suppliers/industries or otherwise with the help of internet	04
7.	Prepare a report on distribution system of a residential colony.	04
8.	To find the p.f. of 3 phase Induction Motor by direct loading. i) Without capacitor Bank (ii) With capacitor Bank.	02
10.	Visit to EHV sub-station.	04

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Basics of Transmission	Lectures, discussion, PPT
2.	Components of Transmission Line	Lectures, discussion, PPT, actual components
3.	Performance Of Transmission Lines	Lectures, discussion, PPT, Problem solving
4.	Distribution System Components	Lectures, discussion, PPT, Problem solving
5.	Sub-Stations	Lectures, discussion, PPT, visit to sub-station

Text Books:

Sr. No	Author	Title	Publication
1	V.K. Mehta	Principles of Power System	S. Chand and Co., Delhi.
2	Soni,Gupta, Bhatnagar	Course of Electrical Power System	Dhanpat Rai and Son's Delhi.

Reference Books:

Sr. No	Author	Title	Publication
1	S.L. Uppal	Electric Power	Khanna Publisher, Delhi.
2	J.B.Gupta	Electrical technology	S.K.Kataria &Sons

Learning Resources: Classroom teaching, Lab work, Text & reference Books, Industry visits.
Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Basics of Transmission	04	06	02	12
2	Components of Transmission Line	06	10	08	24
3	Performance Of Transmission Lines	04	06	06	16
4	Distribution System Components	04	04	08	16
5	Sub-Stations	04	04	04	12
	Total	**22**	**30**	**28**	**80**

(Prof.A.R.Phadke, Prof.J.D.Naik)
Prepared By

(Prof.S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Instrumentation and Control

Course Code : EE 389

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs	--	--	---
Marks	20	80	--	25	--

Course Rationale:

An Electrical Engineer many times requires to work in maintenance department. He is required to handle the various electronic instruments to measure various quantities like pressure, temperature, viscosity, displacement etc. Transducers and instruments are the devices which are used to measure such parameters . The electrical diploma engineer should therefore be competent to use, calibrate and maintain different types of electrical instrumentation systems and transducers used in the industry and power systems. In this subject, the study of various transducers needed for the measurements of various physical parameters, their types and display system with interfacing circuit needed in instrumentation systems is incorporated so that students should be conversant with the basic principles of transduction of physical variables into electrical signals, signal conditioning circuits, basic data acquisitions systems.

Course Contents:

UNIT-1 Introduction to instrumentation System HRS -04 Marks-08		
Major learning outcome		**Topic and subtopics**
1.1	Draw block diagram of an instrumentation system	• Block diagram of generalised instrumentation system.
1.2	Explain the need and function of each block.	• Need and function of each block
1.3	State and explain static characteristics of instruments	• Static characteristics of instruments. 1. Accuracy and Precision. 2. Repeatability and reproducibility. 3. Tolerance. 4. Range and span. 5. Linearity 6. Sensitivity, resolution. 7. Zero drift, sensitivity drift. 8. Hysteresis effect. 9. Dead zone.
1.4	Define Dynamic characteristics of an instruments and enlist various Dynamic characteristics	• Characteristic equation of an instrument in general form. • Zero order, first order and second order representation of instruments.

1.5	Select correct transducer for particular application.	• Selection criterion for Transducer	
	UNIT-2 Transducers HRS -20 Marks-32		**Marks**
2.1	Define and classify Transducer	• Transducer: Definition, Classification based on phenomenon, type of application, types of input and output signal, electrical Principle involved.	2
2.2	Compare mass and volumetric flowmeter	• Difference between mass flow rate and volumetric flow rate.	8
2.3	Describe the Construction and working principle of different types flow meters	• Volumetric flow rate measurement using electromagnetic flow meter, turbine type flow meter and hot wire anemometer, orifice plate,venturi tube, flow nozzle, rotameter, vortex and target type flow meter.	
2.4	Describe the Construction and working principle of Mass flow rate measurement.	• Mass flow rate measurement using Nutating Disc type flowmeter.	
2.5	Enlist the advantages and disadvantages of different types of flow meters	• Advantages and disadvantages of following flow meters 1. Electromagnetic flow meter. 2. Turbine type flow meter. 3. Hot wire anemometer. 4. Orifice plate. 5. Venturi tube. 6. Flow nozzle 7. Rotameter 8. Vortex and target type flow meter. 9. Nutating Disc type flowmeter.	
2.6	Select an appropriate transducer for flow measurement	• Applications of all above flow meter.	
2.7	State the different temperature scales and conversion of these scales.	• Temperature scales. • Farenhit,Rankin,Celsius,	04
2.8	Explain the working principle ,types and characteristics and error occurred for temperature measurement by Thermistor	• Thermistor-working principle, characteristics, sources of error by electronic means.	
2.9	Describe the Construction and working principle, types and ranges of Thermocouple.	• Thermocouple –Construction, working principle, types and their ranges.	
2.10	Describe the Construction and working principle, characteristics and ranges of Resistance thermometer (RTD)	• Resistance thermometer (RTD): working principle, characteristics, ranges of common RTD elements, self heating effect, and advantages of platinum resistance thermometer, three wire and four wire configurations.	
2.11	Explain the procedure of indirect or non-contact type temperature measurement	• Pyrometer:Defination,working Principle, construction and applications	

2.12	Define Pressure and state the different units in which it is measured and need of pressure measurement.	• Definition of pressure and its units. Absolute, differential and gauge pressure. • Need of pressure measurement.	04
2.13	Describe the measurement of pressure using bourdon tube gauge.	• Absolute pressure measurement using bourdon tube gauge: Construction details, working principle, advantages, disadvantages and applications	
2.14	Describe the measurement of pressure using Diaphragm type pressure transducer using four element strain gauge.	• Diaphragm type pressure transducer using four element strain gauge:- Construction details, working principle, advantages, disadvantages and applications.	
2.15	Describe the Construction and working principle of transducers used for linear and angular displacement measurement	• Linear variable differential transformer (LVDT)- working principle, • Rotary motion measurement using optical rotary encoder	06
2.16	Draw the characteristics and	• Characteristics of LVDT	
2.17	Enlist the advantages disadvantages and applications of displacement transducers	• Advantages, disadvantages and applications of LVDT and optical rotary encoder.	
2.18	State the transducer used for Level measurement and describe their construction and working.	• Float type, Resistive, capacitive and ultrasonic level measurement.	
2.19	State the advantages and disadvantages and applications of level transducers	• Advantages and disadvantages and applications of Float type, Resistive, capacitive and ultrasonic level transducers.	
2.20	Describe the construction and working of resistance strain gauge and metal foil strain gauge.	• Operation of resistance strain gauge • Construction of bonded metal foil strain gauge	06
2.21	State and explain Hall effect and hall effect transducer for measurement of ac current	• Hall effect and hall effect transducer for measurement of ac current	
2.22	State the different transducers used for measurement of Rotational velocity and describe their construction and working.	• Rotational velocity Measurement 1.Optical sensing, inductive and magnetic type pulse pickups 2.Analog tachometers (DC and AC)	
	UNIT-3 Signal Conditioning Circuits Hrs-06 Marks-12		
3.1	State the necessity of signal conditioning circuits	• Necessity of Signal Conditioning Circuits • Operational Amplifier as a Signal Conditioning device	
3.2	Draw basic block diagram and pin diagram of OP-AMP and write the pin functions	• Block diagram and features of OPAMP (all stages) Circuit Symbols and Terminals. • OPAMP IC's: 741 pin diagram and pin function.	
3.3	State characteristics and define parameters of op-amp	• Ideal op-amp: electrical characteristics. • Definitions of parameters of op-amp: Input offset voltage, Input offset current, Input bias current, Differential input resistance, Input capacitance, CMMR, SVRR, slew rate, gain OP-AMP basic	

		circuits. • Open loop and closed loop configuration of op-amp, its comparison. • Virtual ground concept.
3.4	Identify different applications of OP-AMP in signal conditioning Circuits.	• Close loop configuration: Inverting, non- inverting, differential amplifier. • Op-amp as a unity gain amplifier (voltage follower) • Op-amp as inverter (sign changer). • Op-amp as Adders, Subtractor, Integrator, Differentiator. • Instrumentation amplifier. • Voltage to current converter (with floating load, with grounded load). • Current to voltage converter.
UNIT-4 - Data Acquisition System HRS -04 Marks 06		
4.1	Draw generalized block diagram of data acquisition system (DAS) and explain the function of each block	• Generalized Data acquisition system:-Block diagram. & function of each block.
4.2	Draw a Pin diagram and write specifications and pin functions of IC LF. 398 as Sample and hold circuit	• Sample and hold circuit (IC LF 398 , Pin diagram, specification and pin functions)
4.3	Classify filters and explain the concept of active and passive filters.	• Classification of filters, Concept of passive & active filters.
4.4	State different types of DAS	• DAS Types:-Single channel, multi-channel DAS only block diagram.
4.5	State working principle of analog-to-digital and digital-to-analog conversion.	• State the different techniques of Analog to Digital convertors. • ADC working principle. • Digital to Analog converters DAC only working principle.
UNIT-5 Display systems and recording Instruments HRS -04 Marks-06		
5.1	Give the classification of recorders	• Classification of recorders
5.2	Draw a block diagram of X-Y recorder and describe its construction and working	• Block diagram, construction and working, applications of X-Y recorder
5.3	State the different types display system and explain their working.	• 7 Segment and 14 segment display system.
5.4	Define Telemetry and draw its block diagram and write function of each block.	• Telemetry:-Basic Block diagram of Telemetry and function of each block.
5.5	Explain the concept of TDM and FDM related with Telemetry	• TDM and FDM
UNIT-06 Control Systems HRS -10,Marks-16		
6.1	Explain the concept of control system and classify it.	• Concept of control system. • Types of control system such as open loop & closed loop.

Elect. Engineering Dept.
Government Polytechnic
Pune 411 016

6.2	Develop block diagram of control system and identify its component.	• Generalized block diagram of control system (e.g. level control, temperature control etc.) and identify its component such as error detector, controller, actuator, process etc.
6.3	Explain the different control system components with sketches	• Actuator – a.c. and d.c. servomotor (no derivation of transfer function). • Solenoid coil. (no derivation of transfer function). • Stepper motor. (no derivation of transfer function). • Synchros valves. (no derivation of transfer function).
6.4	Explain the operation of simple proportional controller with block diagram	• Mode of control system – 1. Simple proportional controller 2. Problems with proportional controller
6.5	Explain the effect of gain Kp on,the response of controller	• Response of proportional controller with low,medium,high proportional gain
6.6	State the effect of derivative gain Kd and integral gain Ki on the performance of closed loop system	• Derivative and Integral function. • Closed loop system with PD, PI, PID controller.
6.7	Explain the process of tuning of PID controller	• Tuning of PID controller

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
1	Study of Rotameter	02
2	To plot the characteristics of RTD.	02
3	To plot the characteristics of thermister.	02
4	To plot the characteristics of thermocouple.	02
5	Measure output voltage and Displacement in LVDT and draw a graph to verify the characteristics of Output Voltages Vs Displacement	02
6	Use a Level measuring transducer to measure level and output voltage & verify the characteristics of the transducer.	02
7	Study of strain gauges and measuring circuits for pressure measurement.	02
8	Measurement of angular velocity.	02
9	Verify the function of OPAMP as inverting/non inverting amplifier, adder, and subtractor.	02
10	Verify the function of OPAMP as integrator and differentiator.	02
11	Verify the function of OPAMP as V to I and I to V converter	02
12	Verify the function of OPAMP as an Instrumentation amplifier	02
13	Study of various display systems.	02
14	Demonstration & use of control system components.	02
15	Demonstration of water level controller.	02
16	Study of P, PI, and PID controller and plot its response.	02

Note:-Minimum TEN practicals from above list at list one on each topic to be performed in the laboratory

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction to instrumentation System	Class room teaching
2	Transducers	Class room teaching, Laboratory work, Industrial visit.
3	Signal Conditioning Circuits	Class room teaching, Laboratory work, Industrial visit.
4	Data Acquisition System	Class room teaching, Industrial visit.
5	Display systems and recording Instruments	Class room teaching, Laboratory work, Industrial visit.
6	Control Systems	Class room teaching, Industrial visit.

Text Books:

Sr. No.	Title	Author	Publication
1.	Electrical and Electronics Measurement and Instrumentation (19th Edition)	A.K.Sawhney	Dhanpat Rai & co
2.	Instrumentation	J.G.Joshi	

Reference Books:

Sr. No.	Title	Author	Publication
1	Instrumentation	Malvino	TMH,Delhi
2.	Op-AMPs and linear integrated circuits	Ramakant Gaikwad	Prentice –Hall India

Learning Recourses :

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's
6. Models 7. Experimentation 8. Diagram Demonstration

Specification Table :

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Introduction to instrumentation System	04	02	02	08
2	Transducers	10	10	12	32
3	Signal Conditioning Circuits	06	04	02	12
4	Data Acquisition System	02	02	02	06
5	Display systems and recording Instruments	02	02	02	06
6	Control Systems	04	04	08	16
	Total	**28**	**24**	**28**	**80**

(Prof.J.D.Naik, Prof.A.R.Phadke)
Prepared By

(S.V. Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Elect. Engineering Deptt.
Government Polytech
Pune 411 (

GOVERNMENT POLYTECHNIC, PUNE

(An Autonomous Institute of Govt. of Maharashtra)

Programme	:	**Diploma in** ET/CE/EE//ME/MT/CM/IT/DDGM
Programme Code	:	01/02/03/04/05/06/07/08/21/22/23/24/26/16/17
Name of Course	:	**Digital Electronics And Microprocessor**
Course Code	:	**ET 390**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**03**	**48**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	**Three class tests, each of 60 minutes**	**3 hrs.**	--	--	--
Marks	20	80	50	--	--

Course Rationale:

Now a day's application of digital circuits and microprocessors are extensively used in measurement and control applications in the field of electrical engineering and electrical power systems. So the digital electronics and microprocessor has been introduced as a subject in electrical engineering curriculum. This course covers digital circuits logic gates Flip-flop, microprocessor 8085 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microprocessor based applications.

Course Objectives:

After studying this course, the student will be able to

- Observe logic circuits
- Assemble Logic circuits
- Test the logic circuit
- Observe logic circuits
- Describe architecture and operation of microprocessor 8085
- Design and develop microprocessor based systems

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

•	Explain various applications of microcontrollers
•	Develop assembly language programs using instruction set of 8085
•	Describe architecture and operation of microprocessor 8085

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Marks
1.	**Introduction to Digital Technique**			
	1.1	Digital signal and Digital Circuit.		
	1.2	Advantages and Disadvantages of digital circuit.		
	1.3	Generation of Digital signal.		
	1.4	Number system- Introduction, decimal, binary, octal & hexadecimal		
	1.5	Conversion of Decimal to Binary Number & vice versa.	08	12
	1.6	Decimal to Hex and vice versa		
	1.7	Hex to binary and vice versa		
	1.8	Octal to decimal and vice versa		
	1.9	Octal to binary and vice versa.		
	1.10	BCD number system.		
	1.11	1's compliments and 2's compliment.		
	1.12	Addition and Subtraction of Binary number.		
2.	**Logic gates and Boolean Algebra**			
	2.1	Logical symbol, logical expression and truth table of AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR gates.		
	2.2	Universal gates – NAND, NOR Gates.		
	2.3	Logical circuit of basic gates using universal gates.		
	2.4	TTL and CMOS Logic gates IC's and their Pin configuration.		
	2.5	Boolean Algebra – Fundamental concept, Basic Laws of Boolean Algebra.	08	16
	2.6	Half-adder and Full – adder.		
	2.7	Introduction to Flip-Flop. - RS Flip-Flop, J.K.Flip-Flop, T & D Flip-flop and their Field of applications of flip-flop.		
	2.8	Introduction to Registers , shift to right and shift to left registers		
	2.9	Introduction to counter – up counter, down counter and decade counter		
3.	**Introduction to Microprocessor**		06	12

	3.1 3.2 3.3 3.4	Microprocessor as Physical system, pin diagram & Pin configuration of Intel 8085 Microprocessor. Architecture and organization of INTEL 8085. Data bus, Control bus, CPU, ALU, accumulator. Programming model of INTEL 8085		
4.		**INTEL 8085 Assembly Language Programming**		
	4.1 4.2 4.3 4.4 4.5 4.6 4.7	Instruction set for 8085/8085A Microprocessor. Addressing modes of 8085 Microprocessor. Data movement instruction, PUSH and POP, increment & decrement instruction, Rotate and shift instruction. Arithmetic Instructions such as add, sub. Compliment /decimal adjustment instruction. Logical instructions such as AND OR & EX-OR instruction. Branching instructions: - Jump, Call & instruction, conditional Jump call & Return instruction. Looping instructions Simple Programming on Addition, subtraction, multiplication, division, data movement, sorting, find largest/smallest number.	**10**	**20**
5.		**Memories**		
	5.1 5.2	Semiconductor memories: RAM, ROM volatile and non-volatile RAM. Memory Map.	**02**	**04**
6.		**Timing Diagram**		
	6.1	Timing diagram of fetch operation , read operation & right operation (with & without ATT States)	**04**	**06**
7		**Interfacing the Microprocessor**		
	7.1 7.2	General purpose programmable devices IC's:8255, 8253, 8237& key board interfacing 8279. Introduction to serial communication RS-232C		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment
1	Verification of Truth table of logic gates.
2	Verification of De Morgan's Theorem
3	Verification of Truth Table of Flip-flops
4	Study of A/D Convertor.
5	Study of data sheets related to digital IC's
6	Assembly Language programming on – • 1's compliment • shift left operator • 8 bit addition of two numbers • 16-bit addition of two numbers • 8-bit subtraction of two numbers • Binary division • To find larger number • To find smaller number • To find largest number • To find smallest Number • To arrange numbers in ascending order • To arrange numbers in descending order.
7	Study of 8255 PPI IC
8	Study of 8279 PPI IC

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction to Digital Technique.	Classroom teaching and laboratory work.
2	Logic gates and Boolean Algebra.	Classroom teaching and laboratory work.
3	Introduction to μP.	Classroom teaching and laboratory work.
4	INTEL 8085 Assembly Language Programming	Classroom teaching and laboratory work.
5	Memories	Classroom teaching and laboratory work.
6	Timing Diagram	Classroom teaching and laboratory work.
7	Interfacing the microprocessor	Classroom teaching and laboratory work.

Text Books:

Sr. No	Author	Title	Publication
1	Malvino	Principles of Digital Electronics	Mcgraw Hill
2	R.P.Jain	Digital Electronics	Tata Mcgraw Hill
3	B.Ram	Microprocessor &	S.Chand

Reference Books:

Sr. No	Author	Title	Publication
1.	Pal mer	Introduction to digital systems	Mcgraw Hill
2.	Mathur	Introduction to microprocessor	Tata Mcgraw Hill

Learning Resources: Class room & laboratory work, Reference books, Machine catalogs, Transparencies.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Introduction to Digital	04	02	06	12
2	Technique.	04	06	06	16
3	Logic gates and Boolean	06	04	02	12
4	Algebra.	04	06	10	20
5	Introduction to μP.	02	02	00	04
6	INTEL 8085 Assembly	02	04	00	06
7	Language Programming	04	04	02	10
	Total	**26**	**28**	**26**	**80**

Prepared By:

N.S.Bakade.	S.V.Chaudhari	R.N.Shikari.
Lect. In E &TC	Member Secretary, PBOS	Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Programme Code : 02 / 16 / 22

Name of Course : Electrical Machine Design

Course Code : EE 583

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	-	6	20	80	-	50	-	150	YES

Course Rationale:

Course Content:

	Major Learning Outcomes	Topic and subtopics
	Unit -1 Introduction to Design of three phase transformer Hrs 04 Marks 10	
1.1	State the working principle of transformer and explain the function of different parts of the transformer.	Review of construction and working of three phase transformer.
1.2	State the different types of core constructions and their advantages.	1. Core construction. • Core Construction-types • Advantage of using stepped core over rectangular core • Limb section • Yoke construction
1.3	State the types of windings and factors governing choice of winding.	2. Transformer windings • Factors governing choice of winding • Types of windings.
	Unit-2 Design of Three phase Transformers Hrs 08 Marks 14	
2.1	Write the step by step procedure to design three phase transformer. Calculate dimensions of core, yoke and winding details for given rating and type of three phase transformer.	1. Output equation of 3 phase transformer. 2. Design of transformer- • Core design. • Window dimensions • Yoke design • Overall dimensions of frame • L.V. winding & H.V. winding
	Unit-3 Cooling of transformers Hrs 06 Marks 08	
3.1	Describe the necessity of cooling system for transformer. State and explain different types of cooling systems of transformers.	1. Cooling systems. Transformer oil as a cooling medium. Temperature rise in plane walled tanks.
3.2	Step by step procure to design tank with cooling tubes. Calculate number of cooling tubes	2. Transformer tank and calculation of number of cooling tubes.

LEVEL-IV

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
AU481	Environmental Science@	--	2	--	2	--	--	50	--	--	50
AU483	Renewable & Sustainable Energy	2	--	--	2	20	80	--	--	--	100

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
MA482	Industrial Organisation and Management	3	--	--	3	20	80	--	--	--	100

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
EE481	Project and Seminar (In-house / Industry)	--	8	--	8	50	--	50	50	--	150
EE482	Power Electronics and Drives	3	2		5	20	80	--	--	25	125
EE483	Electrical Machine - II	4	2	--	6	20	80	--	--	25	125
EE484	Testing and Maintenance of Electrical Equipment	4	2	--	6	20	80	--	--	50	150
EE485	Switchgear and Protection	3	2	--	5	20	80	--	25	--	125
EE486	Electrical Estimation and Costing	3	2	--	5	20	80	--	25	--	125
EE487	Utilisation of Electrical Energy	3	2	--	5	20	80	--	25	--	125
EE488	Energy Audit and Conservation	3	--	1	4	20	80	--	--	--	100

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
NC481	Development of Soft Skills - I	--	2	--	--	--	--	25	--	--	25*
NC482	Development of Soft Skills - II	--	2	--	--	--	--	25	--	--	25*

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Name of programme	: CE/ EE/ET/ME/MT/CM/IT/DDGM
Programme Code	: 01/02/03/04/05/08/21/22/23/24/15/16/17/18/19
Name of course	: Environmental Science
Course code	: AU481

Teaching Scheme:

	Hours/Week	Total Hours
Theory	--	--
Term work / Practical	2	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	--	--	--	--	--
Marks	--	--	--	--	50

Sr. No	Topic/Subtopic	Hours	Weightage	Practical
1.	**Introduction** 1.1 Need of the study of environmental science, definition scope and importance of environmental studies. 1.2 Environment & its component need of public awareness, effect of human activities on technological environment. 1.3 Depleting Nature of environmental sources such as soil, water, minerals & forests. Need of conserving natural resources preserving the environment.	04		
2.	**Sustainable Development:** 2.1 Concept of sustainable development. 2.2 Social, Economical & Environmental aspect of sustainable development. 2.3 Control measure: 3 R (Reuse, Recovery, and Recycle). Appropriate Technology, Environmental education.	04		
3	**Environmental Pollution:** 3.1 Introduction. 3.2 Water Pollution: Sources of water pollution-Sewage, Industrial waste, Agriculture chemicals, Thermal & radioactive waste, Heavy metals. Effects of water pollution. Control of water pollution. 3. 3 Air pollution: Introduction, sources of air	16		

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

	pollution, types of air pollution, effects of air pollution, control measures of air pollution. 3.4 Concept of Global Warming, Ozone Layer Depletion, Acid rain, Greenhouse effects. 3.5 Noise Pollution: Definition, Classification of noise pollution, effects of noise pollution, control of noise pollution. 3.6 Land Pollution: Causes, effects and remedies. 3.7 E-Pollution: Definition, Causes and effects and remedies measures. 3.8 Introduction to solid waste management. 3.9 Water Conversation: Rainwater harvesting, Watershed Management			
4	**Renewable sources of Energy:** Biomass, Biogas, Solar Energy, Nuclear Power, Hydropower, Wind Energy, Ocean (Tidal Energy), Geothermal Energy.	04		
5	**Environmental Legislation:** 5.1 Introduction 5.2 Ministry of Environment and Forest. (MOEF) Organizational Structure of MOEF. 5.3. Functions & Powers of Control Pollution Control Board. 5.4 Functions & Powers of State Pollution Control Board. 5.5 Environment Protection Act.	04		

Assignments:

1. Study of air quality of Pune city.
2. Study of noise pollution in Pune city.
3. Study of solid waste management of Pune city.
4. Study of E-waste management of Pune city.
5. Study of Environmental Status Report of Pune city prepared by Pune Municipal Corporation.

Text Books:

Sr. No	Author	Title	Publication
1	S.P. Nisture, D. A. Joshi, G.S.Chhawsaria	Basic Civil and Environmental Engineering	Pearson
2	Anindita Basak, D.L. Manjunath	Basics of Environmental Studies	Pearson
3	L.D. Danny Harvey	Global Warming The Hard Science	Pearson

4	Benny Joseph	Environmental Studies	TataMcGraw Hill
5	Godfrey Boyle	Renewable Energy	Oxford Publications
6	R. Rajagopalan	Environmental studies	Oxford University Press

Websites:

1. **http://www.mpcb.gov.in/**
2. **http://www.cpcb.nic.in/**
3. **http://www.envfor.nic.in/**
4. **http://www.neeri.res.in/**

Prepared by

R.M.Aghav
V.M. Kolhe
D.K. Fad
LCE

(S.V.Chaudhari)
Member Secretary, PBOS

Dr S M S Shobhidhara,
(M.S.Satarkar)
Chairman, PBOS

Programme	:	**Diploma in CE/EE/ET/ME/MT/CM/IT**
Programme Code	:	**01**/02/03/04/05/06/07/08/**21**/22/23/24/26/**15**/16/17/18/19/24
Name of Course	:	**Renewable & Sustainable Energy Management**
Course Code	:	**AU483**

Teaching Scheme:

Theory/Practical	Hours/ Week	Total Hours
Theory	02	32
Practical	--	--

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	Two class tests each of 60 minutes	3 Hrs	--	--	--
Marks	**20**	**80**	--	--	--

Course Rationale:

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. The conventional sources of energy are insufficient to meet these demands. Hence alternative energy sources are utilized for power production. The use of alternative energy source is increasing day by day. Diploma Engineers are to develop, operate and maintain these systems therefore essential to know basics of energy conversion, conservation, energy audit and waste heat recovery techniques.

Course Objectives:

	After studying this course, the student will be able to
1	Know the National scene of energy production, utilization, consumption and reserves.
2	Appreciate the need for non-conventional energy sources.
3	Understand relative advantages and disadvantages of various non-conventional energy sources.
4	Develop awareness for effective utilization of alternative energy sources.
5	Identify different components of solar energy and wind energy sources.
6	Identify and analyze biomass plant.
7	Identify and apply energy conservation techniques for commonly used Power absorbing and generating devices.
8	Apply principles of energy conservation and energy management techniques.

Course Content:

Chapter No.		Name of Topic/Sub topic	Hrs	Marks
1.		**Review of conventional sources of energy**	03	06
	1.1	Types of conventional energy sources, availability and important power plants in India		
	1.2	India's production and reserves for fossil fuels, waterpower, nuclear power.		
	1.3	Need for non-conventional energy sources.		
	1.4	Environmental impact of various energy sources. Green building, sustainable development. Carbon credits and its signifcance		
2.		**Solar Energy**	04	10
	2.1	Principle of conversion of solar energy into heat and electricity. Solar radiation. Solar radiations at earth's surface		
	2.2	Solar radiation geometry- declination, hour Angle, altitude angle, incident angle, zenith angle, solar azimuth angle		
	2.3	Solar collectors and their types, application, advantages and limitations		
3.		**Applications of Solar Energy**	04	10
	3.1	Solar electric power generation: Solar photovoltaic cell, solar cell principle and working, its application, advantages and disadvantages.		
	3.2	Solar water heating, solar distillation, solar cooking and furnace,		
	3.3	Solar pumping and Green house, Agriculture and industrial process heat.		
	3.4	Space heating, space colling,		
4.		**Wind Energy**	05	16
	4.1	Basic principles of wind energy conversion, power in wing, available wind power formulation, power coefficient, and maximum power		
	4.2	Main considerations in selecting a site for wind mills, advantages and limitations of wind energy conversion		
	4.3	Classification of windmills, construction and working of horizontal And vertical axis wind mills, their comparison.		
	4.4	Main applications of wind energy for power generation and pumping.		
		Energy From Biomass		
5.	5.1	Common species recommended for biomass, methods for obtaining energy from biomass.	05	12
	5.2	Classification of biomass- gasified, fixed bed and fluidized		
	5.3	Application of gasifier		
	5.4	Biodiesel production and application		
	5.5	Agricultural waste as biomass, biomass digester, comparison of biomass with conventional fuels.		
6.		**Geothermal Energy and Tidal Energy**	06	16
	6.1	Availability, forms of geothermal energy- Dry steam, wet steam, hot dry rock, magnetic chamber system		

Mech. Engineering Deptt.
Government Polytechnic
Pune 411 016

	6.2	Different power plants available.		
	6.3	Tidal power, factors for selection of tidal power plant		
	6.4	Classification- Single basin, double basin type		
	6.5	Tidal power plants in world, ocean thermal plants.		
7.	**Energy Conservation and management**			
	7.1	Energy conservation and management, need and importance of energy conservation and management	05	10
	7.2	Concept of payback period, return on investment, life cycle cost, Sankey diagrams, specific energy consumption. Distribution of energy consumption.		
	7.3	Energy audit, types of audit, methods of energy conservation		
	7.4	Cogeneration and its application.		
Total			**32**	**80**

List of Assignments:

Sr. No.	Name of Assignment
1.	To collect information about global and Indian energy market
2.	One field visit to be conducted to demonstrate application of Solar Energy
3.	One field visit to be conducted to Wind Mill
4.	To visit a biomass/ biogas plant of municipal waste or elsewhere.
5.	Perform energy audit for workshop/Office/Home/SSI unit.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Review of conventional sources of energy	Classroom teaching and Internet browsing
2	Solar Energy	Classroom teaching and field visits, use of charts
3	Wind Energy	Classroom teaching, field visit & use of charts
4	Energy From Biomass	Classroom teaching, field visit & use of charts
5	Geothermal Energy	Classroom teaching and Internet browsing
6	Tidal Energy	Classroom teaching and Internet browsing
7	Energy Conservation	Classroom teaching
8	Energy Conservation Techniques	Classroom teaching and case study

Text Books:

Sr. No	Author	Title	Publication
1	Non conventional energy resources	Dr B.H.Khan	Tata McGraw Hill
2	Non conventional energy Resources	G. D. Rai	Khanna publication

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Reference Books:

Sr. No	Author	Title	Publication
1.	Solar energy	S. P. Sukhatme	Tata McGraw Hill
2.	Solar energy	H. P. Garg	Tata McGraw Hill
3.	Power plant engineering	Arrora Domkundwar	Dhanpat Rai & co.
4.	India- The energy sector	P.H. Henderson	Oxford University Press
5.	Industrial energy conservation	D. A. Ray	Pergaman Press
6.	Non-conventional energy source	K. M. Mittal	---
7.	Energy resource management	Krupal Singh Jogi	---
8.	Website for Akshay Urja News Bulletin. (www.mnes.nic.in)	---	---

Learning Resources: Charts of solar water heater and cooker, Models of solar water heater and cooker, Photovoltaic cells etc., video cassette no.131, 365 of G.P.P. library

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Review of conventional sources of energy	06	--	--	06
2.	Solar Energy	04	06	--	10
3.	Application of Solar Energy	--	04	06	10
4.	Wind Energy	04	04	08	16
5.	Energy From Biomass	04	02	06	12
6.	Geothermal & Tidal Energy	06	04	06	16
7.	Energy Conservation Management	04	06	--	10
	Total	**28**	**26**	**26**	**80**

Prepared By

(E.C.Dhembare)
L.M.E.

(S.V.Chaudhari)
I/C CDC & Member Secretary,
PBOS

(A.S.Zanpure)
H.M.E.D. &
Chairman,PBOS

विभाग प्रमुख
विद्युत अभियांत्रिकी
शासकीय तंत्रनिकेतन, पुणे.

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Diploma Programme in Civil Engineering
Programme Code : 01/02/03/04/05/06/07/08/21/22/23/24/26/15/16/17/18/19
Name of Course : Industrial Organization Management
Course Code : MA482

Teaching Scheme:

Theory/Practical	Hours/ Week	Total Hours
Theory	03	48
Practical	--	--

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	Two class tests of 60 min Duration	3 Hrs	--	--	--
Marks	20	80	--	--	--

Course Rationale:

At the end of course, student will be able to	
1	Create necessary awareness and motivation of technical student for promoting self-employment and alternative to wage employment
2	Develop skill for organization market survey and managements.
3	Appreciate importance of human relations in industry.

Course Objectives:

After studying this course, the student will be able to	
1	The basic knowledge about entrepreneurship.
2	Fundamentals of accounting finance, marketing.
3	Various aspects of management, Taylor's principle.
4	Management techniques.
5	Different acts used in factories.

Contents:

Topic No.	Topic & Subtopic		Hrs	Marks
1	**Overview of Business and Entrepreneurship**		05	08
	1.1	Type of Business: Service, Manufacturing, Trade. Industrial sectors introduction to : Engineering Industry, IT Industry, Banking, insurance, Retail. Globalization: Introduction, Advantages and Disadvantages with respect to India.		
2	**Organizational Management**		08	14
	2.1	Organization : Defination, Steps in organization, Types of Organization : Line, Functional, Line and Staff, Project. Departmentation : By product, by process by function. Principles of Organization : Authority and responsibility, Span of control, Effective delegation, Communication. Forms of Ownership : Proprietorship, Partnership, Joint stock, Co-operative society, Government sector.		
3	**Management Process**		08	14
	3.1	What is management: Evolution, Various definition of management, concept of management, Levels of management, administration of management, scientific management by F.W. Taylor. Principle of management : Function of management: Planning, organizing, directing, coordinating, controlling.		
4	**Financial Management and Accounting**		07	12
	4.1	Financial management objective and function. Capital generation and management: type of capital-fixed and working, sources of raising capital, feature of short term, medium term and long term sources. Budget and account: types of budget, production budget-sample format, fixed and variable budget-concept, profit and loss account, important accounting terminology, types of account: rules for debit and credits, systems of book keeping, book keeping, books of accounts. Balance sheet: meaning, sample format, meaning of different terms involved.		
5	**Material Management**		07	12
	5.1	Inventory concept, its classification, functions of inventory : ABC analysis-necessity and steps : Economic order quantity concept, graphical representation, determination of EOQ Standard steps in purchasing Modern technique of material management: material resources planning (MRP)-function of MRP, input to MRP, benefits of MRP. Enterprise resource planning (ERP)-concepts, list of modules, advantages and disadvantages of ERP.		
6	**Marketing**		05	08
	6.1	Market survey, definition, modern concept of marketing orientation, project report preparation, utility, project report preparation of utility for evaluation, market oriented report, product costing, project costing, format, evaluation of project report, costing and pricing, classification of costs, calculation of breakeven point, packing and advertising.		

7		**Industrial Safety and legislative acts**	04	06
	7.1	Safety management: cause of accident, types of industrial accident, preventive measure, safety procedure. Industrial legislation – necessity of acts: important definition and main provision of following act – workman compensation act, minimum wages act, Indian factory act.		
8		**Quality management and ISO**	04	06
	8.1	Meaning of quality: quality management system - activities, benefits, Quality control-objective, function, advantages, quality circle-concepts, characteristics and objectives, quality assurance-concepts; quality assurance system. Meaning of total quality and TQM components of TQM-concept, element of TQM benefits, Modern technique and system of quality management like-Kaizen, 5S, Six Sigma. ISO 9001:2000: benefits, Main clauses.		
		Total	**48**	**80**

Instructional Strategy:

Sr. No	Topic	Instructional Strategy
1	Overview of Business and Entrepreneurship	Class room teaching
2	Organizational Management	Class room teaching
3	Management Process	Class room teaching
4	Financial management and accounting	Class room teaching
5	Material management	Class room teaching
6	Marketing	Class room teaching
7	Industrial safety and legislative acts	Class room teaching
8	Quality management and ISO	Class room teaching

Reference Book:

Sr. No.	Author	Title	Publisher
1	Sept. 1988, TTTI, Chandigarh	Entrepreneurship development training material	Sept. 1988, TTTI, Chandigarh
2	March. 1988, TTTI, Chandigarh	Report for institutional entrepreneurship development and management courses in selected institutions	March. 1988, TTTI, Chandigarh
3	Uday Parikh, T.V. Rao and D.M. Pestonjee	Behavioural processes in organizations	Tata McGrawhill
4	O.P. Khanna	Industrial engineering and management	Dhanpat Rai and Sons.
5	Banga and Banga	Project Planning and entrepreneurship	Khanna Publishers.
6	David, Kroenke	Management Information Systems	McGraw Hill Book Co.
7	Lester R. Bittel, John W. Newstrom	What every supervisor should know	McGraw Hill Book Co.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Entrepreneurship development	03	03	--	06
2	Finance and accounting	06	02	--	08
3	Marketing Fundamentals of accounting	--	04	04	08
4	Organization	06	02	--	08
5	Management	07	04	04	15
6	Acts	10	10	06	26
7	Fields of industrial psychology	04	--	--	04
8		05	--	--	05
	Total	**40**	**26**	**14**	**80**

Prepared By

(C.Y. Potewar)

(S.V.Chaudhari)
Member Secretary, PBOS

(A.S.Zanpure)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16
Name of Course : Project and Seminar in In-House/Industry

Course Code : EE 481

Teaching Scheme:

	Hours/Week	Total Hours
Theory	---	---
Practical	08	128

Evaluation Scheme :

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	--	--	--	03 Hrs	---
Marks	50	--	--	50	50

Course Rationale:
Project work includes a range of design exercises, computing courses, industrial projects, builds and test projects. For a technician knowledge of scientific problem solving and application of this knowledge to real life situations is very important. Project and Seminar helps him to develop this competency. It further helps him to develop professional skills such as market survey, making presentations and report writing. The ability to carry out practical work and to present the results is obviously a key skill for all engineers to develop.

Course Objectives:

- To develop the skill of problem identification and problem solving.
- To develop the skill of searching information required for problem solving from number of sources.
- To develop presentation and report writing skills.

Course Content:

Chapter no	Activities/Topics		Weigh tage
1.	Form project batches & allot project guide to each batch. (5-6 students per batch)		
2.	Each project batch should select topic/problem/work by consulting the guide &/or industry. Topic/Problem/work should be approved by Head of department. Each project batch should prepare action plan of project activities & submit the same to respective guide, it will be part of project.		
3.	The Topic/Problem/work preferably from the field of Electrical engineering. The project may be of the following fields or nature. • Manufacturing/Fabrication of a prototype unit. • Improvement of the existing equipment/process using recent techniques. • Energy audit/use of renewable energy sources. • Electronic/Microprocessor/Microcontroller based control of electrical machines, system etc. • Industrial Automation (PLC/HMI/SCADA) fields. • Illumination Scheme for Hospital / Shopping Mall / Cinema Theatre / Commercial Complex / Educational Institute / Industrial Complex by using illumination design software. • Design of Rural Electrification Scheme for small Village, Colony. • Electrical Installation of electrical equipments.		50 Oral+ 50 TW

4	**Seminar:** Seminar should be based on detailed study of any topic related to engineering field. This topic must be on his/her project or out of the curriculum.		50 PA
5	**Format For The Project Report:** • The student should submit a detailed report based on his/her project work. It should include relevant circuit diagrams, graphs, specification sheet etc. **The Project Report Should Have:** • Project work approval sheet in the form of a certificate, duly signed, should be included. • The report should be neatly typed on white "A-4"size paper. The typing should be of normal spacing and only on one side of the paper. Proper font and text size should be used. • The format of the text of the report should be as follows A) Index B) Synopsis or abstract. C) Analytical and experimental work done. D) Conclusions. E) Bibliography. • The total number of typed pages should be about 50 to 100.		
	Total		150

Prepared By	Secretary, PBOS	Chairman, PBOS
(Prof.U.S.Tulangekar)	(Prof. A.S.Zanpure)	(Prof.M.A.Chigteri)

Programme : Diploma in EE

Programme Code : 02 / 16 / 22

Name of Course : Power Electronics and Drives

Course Code : EE 482

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
3	2	0	5	20	80	--	25	--	125	YES

Course Rationale:

The course aims is to prepare the technicians to carry out the responsibilities related to electronics control by using power devices like thyristors. Power Electronics have already found an important place in Modern Technology and are now used in a great variety of high power products including heat control, light control, power control, motor controls, power supplies, vehicle, H.V.D.C. system etc.

Electronic control circuits have major role in Industries for which study of power devices is essential. Concepts of electronic devices and circuits along with their applications are necessary.

Course Content:

	Major Learning Outcomes	Topic and subtopics
Section 1		
Unit -1 Power Devices Hrs 08 Marks 16		
1.1	Classify different power devices	• Introduction to power devices.
1.2	Describe the construction and working of SCR	• SCR: Construction and working of SCR • Operating Principle with Two transistor analogy • Applications of SCR, LASCR, SCS
1.3	Draw V-I characteristics and define terms Latching Current (IL) and Holding Current (IH).	• V-I characteristics • Latching Current (IL) • Holding Current (IH)
1.4	Identify thyristors and triggering devices.	• Thyristor family devices LASCR,SCS, GTO and TRIAC: Construction, Operating Principle • Triggering Devices- Construction, Operating Principle
1.5	Interpret V-I characteristics of different power devices and state their applications.	• V-I characteristics and applications of LASCR,SCS, GTO and TRIAC • V-I characteristics and applications of UJT, PUT, SUS, SBS and DIAC.
Unit-2 Turn ON and Turn OFF methods of SCR Hrs 08 Marks 12		
2.1	Know the different techniques to Turn ON SCR	• Concept of Turn ON mechanism of SCR: 1. High Voltage triggering 2. Thermal triggering 3. Illumination triggering 4. dv/dt,triggering 5. Gate triggering of SCR.:-Gate trigger circuits – Resistance triggering circuit, Resistance Capacitance triggering circuit (Operation, applications and limitations) 6. SCR triggering using UJT

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

2.2	Know the different methods to Turn OFF SCR	• Concept of Turn OFF mechanism and methods of line commutation and forced commutation. 1. Class A- Series resonant commutation circuit, 2. Class B-Shunt resonant commutation circuit, 3. Class C-Complimentary Symmetry commutation circuit.
Unit-3 Controlled Rectifier 08 Hrs Marks 12		
3.1	Describe the working of Single phase fully controlled half wave converter	• Single phase fully controlled half wave converter With resistive load, RL load without freewheeling diode, RL load with freewheeling diode.
3.2	Describe the working of Single phase full wave converter	• Single phase full wave controlled converter 1. With resistive load 2. With RL load
3.3	Explain the operation of Three phase half wave and full wave rectifier	• Three phase half wave and full wave rectifier.
3.4	Compare single phase and three phase converters	• Comparison of single phase and three phase converters
SECTION-2		
Unit-4 Cycloconverters Hrs 06 Marks 08		
4.1	Explain the principle of operation of cycloconverters	• Basic principle of operation of cycloconverters.
4.2	Identify the different types of cycloconverters for required applications their control circuit and waveforms	• Single phase to single phase , three phase to single phase, three phase to three phase , control circuit
Unit-5 Choppers Hrs 06 Marks 08		
5.1	Explain the principle of operation of chopper and its necessity	• Principle of operation of choppers.
5.2	List the different types of chopper and describe their operation and application	• Step up, Step down and Jone's chopper. • Applications.
Unit-6 Inverters Hrs 06 Marks 12		
6.1	Know the necessity of inverters	• Requirement of inverters
6.2	Classify the inverters and specify their applications	• Series and parallel Inverters :-Operation of basic series and parallel inverters • Single phase and Three phase inverters • Applications
6.3	Explain the operation of UPS and SMPS	• UPS, SMPS
Unit-7 Electronic Power Control Hrs 06 Marks 12		
7.1	Know the requirement of DC Drives	• D.C.Drives:- 1. Speed control of DC series motor with 1Ø and 3Ø half and full control converter, step up and step down chopper . 2. DC servo motor(working and Construction): speed control of DC servo motor Close loop speed control method for D C servo motor .
7.2	Selection of SCR circuit for AC-drives	• Speed control of three phase induction motor with Variable frequency control : Voltage source inverter, current source inverter, cycloconverter • Stepper motor :Variable reluctance , Permanent magnet-

		step control • Synchronous motor drives • AC Servo drives (use of SCR for above application is expected but not detailed circuitry)

List of Practicals/Experiments/Assignments:

Sr. No	Name of practical/Experiment/Assignment	HRS
1.	To identify SCR terminals and test SCR	02
2	To plot VI characteristics of SCR.	02
3.	Trace the given circuit of UJT relaxation oscillator and plot and analyze the output waveforms.	04
4.	To plot characteristic of firing angle alpha Vs Vdc of converter	02
5.	Trace the given circuit of cycloconverter and plot & analyze the output waveforms.	04
6.	Trace the given circuit of chopper and plot & analyze the output waveforms.	04
7.	Trace the given circuit of parallel inverter and plot & analyze the output waveforms.	04
8.	Testing of UPS	02
9.	Trace the given circuit of thyristerised speed control of d.c. motor and analyze the results	04
10.	Trace the given circuit of thyristerised a.c. motor drive and analyze the results.	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Power Devices	Lecture Method, Chalk Board technique
2.	Turn ON and Turn OFF methods of SCR	Lecture, Q/A technique
3.	Controlled Rectifier	Lecture, Q/A technique
4.	Cycloconverters	Lecture Method, Q/A technique
5.	Chopper	Lecture Method, Q/A, technique
6.	Inverter	Lecture Method, Q/A, technique
7.	**Electronic Power Control**	Lecture Method, Q/A, technique

Text Books:

Sr. No	Author	Title	Publication
1.	M.H. Rashid	Power Electronics Circuit Devices and Applications	Prentice Hall of India Pvt. Ltd. New Delhi

1.	M.H. Rashid	Power Electronics Circuit Devices and Applications	Prentice Hall of India Pvt. Ltd. New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Dr. M. Ramamurthy	Power Electronics	East West Press Pvt. Ltd.
2.	P.C. Sen M.D. Singh	Thyristors Drives SCR Lab. Manuals Power electronics	TATA Magraw Hill New Delhi

Learning Resources: Handouts, Manuals, Data books etc

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION-1				
1	Power Devices	06	06	04	16
2	Turn ON and Turn OFF methods of SCR	06	06	00	12
3	Controlled Rectifier	04	04	04	12
	Total (Section-1)	16	16	08	40
	SECTION-2				
4	Cycloconverters	02	04	02	08
5	Chopper	02	02	04	08
6	Inverter	04	04	04	12
7	Electronic Power Control	04	04	04	12
	Total (Section-1)	12	14	14	40
	Total	**28**	**30**	**22**	**80**

Prepared by R.N. Shikari

Mr.S.V.Chaudhari
Member Secretary PBOS

Mrs.M.A.Chigteri
Chairman PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Name of Programme : EE

Programme code : 02/16/22

Name of Course : A. C. Machines

Course Code : EE 483

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Tutorial	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	01 Hour	03 Hours			---
Marks	20	80	50		

Course Rationale:

This subject is classified under core technology group. It is intended to teach the students facts, concepts, principles, operation and testing of Electrical machines such as induction motors and alternator.

These machines are used in all types of manufacturing industries and for generation of electricity. Most of the machines used in industry are induction motor. The knowledge gained by the student is useful in the study of subjects such switchgear & protection, utilization of electrical power, testing and maintenance of electrical equipment and in their project work.

The knowledge and skills gained will be helpful while performing duties of electrical supervisor, maintenance engineer, quality control engineer etc.

Course Contents:

Section I		
UNIT-1 Three Phase Induction Motor HRS - 12 + (04T) Marks - 20		
	Major learning outcome	Topic and subtopics
1.1	Explain constructional features of 3 phase I.M. and differentiate between squirrel cage and slip-ring induction motors.	• Induction motor - construction of I.M., types, comparison between squirrel cage and wound rotor induction motors.
1.2	Explain how rotating magnetic field is produced and working principle 3 phase induction motor.	• Production of rotating magnetic field in 3 phase windings when balanced 3 phase supply given to them. • Working principle of I.M.
1.3	Understand the Slip and its significance in the operation of three phase induction motor.	• slip, frequency of rotor induced emf, rotor current.
1.4	Develop an expression for rotor induced emf and current. Know the rotor parameters at standstill and running condition.	• Equation of rotor induced emf, current, rotor resistance & reactance, i.e., impedance at standstill & and under running condition.
1.5	Derive torque equation of three phase induction motor & condition for maximum torque.	• Torque equation of three phase induction motor. • Starting and running torque of induction motors. • Condition for maximum starting and running torque. • Full load, starting & maximum torques

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

1.6	Explain the torque- slip characteristics of induction motor and effect of change in supply voltage & rotor resistance on the characteristics.	• Torque- slip characteristics of three phase induction motor. • Effect of change in supply voltage on torque-slip Characteristics. • Effect of change in rotor circuit resistance on torque-slip characteristics. • Induction generation operation with the help torque-slip characteristics.
1.7	Describe various methods of slip measurement of 3 phase induction motor.	• Measurement of slip by a) Actual speed measurement b) Stroboscopic method c) Galvanometer method.
UNIT-2 Performance of Three Phase Induction Motor HRS - 12 + (04T) Marks - 20		
2.1	Explain various methods of speed control of 3 phase induction motor.	• Speed control of three phase induction motor by a) Pole changing method b) frequency control method c) stator voltage control d) Rotor resistance control method e) PWM technique.
2.2	State the losses in I.M. and determine the efficiency. Explain the power flow diagram of three-phase induction motor.	• Various losses in I.M. and efficiency. • Power flow diagram of I.M. • Calculation of efficiency from power flow diagram.
2.3	Explain the equivalent circuit of 3-phase induction motor.	• I.M. as short-circuited transformer. • Phasor diagram of I.M. • Equivalent circuit of three phases I.M. (No numerical)
2.4	List the applications of various types of induction motors.	• Applications of three phase Induction Motors • Comparison of I.M. with DC shunt motor.
2.5	Justify the need of starter for induction motor and describe various methods of starting.	• Necessity of starter. • Types of starters. a) DOL Starter. b) Star/delta starter c) Auto transformer starter d) Rotor resistance starter e) Soft starters.
2.6	Explain constructional features, characteristics of double squirrel cage induction motor & list out its applications.	• Construction, Characteristics and Applications of double squirrel cage Induction Motor.
Section II		
UNIT-3 Three Phase Alternator HRS -18 + (06T) Marks-28		
3.1	Describe the function of different parts of an alternator with sketches.	• Construction of three phase Alternator, a) Armature windings b) Rotor- salient pole type & non salient pole type. • Advantages of stationary armature, construction. • Excitation of rotor field system.
3.2	Explain the working principle of an alternator.	• Working principle of an alternator.
3.3	Derive emf equation of an alternator	• E.m.f. equation of Alternator • Effect of short pich coil on induced emf and pitch factor. • Effect of distributed winding on induced emf and distribution factor. • Use of damper winding.
3.4	Explain the factors affecting on terminal voltage of an alternator.	• Factors affecting the terminal voltage of Alternator a) Armature resistive drop b) Leakage reactance drop. c) Armature reaction at various power factors. d) Concept of Synchronous impedance. e) Phasor diagram of alternator on different loads.
3.5	Determine the voltage regulation of an alternator by different methods	• Regulation of three phase Alternator by a) Direct loading b) Synchronous impedance method c) mmf method.
4.6	Understand the synchronization of an alternator, parallel	• Synchronizing by 1) All dark method 2) One dark and two bright lamps 3) Synchroscope

	operation & load sharing of alternators.	• Synchronizing current, power and torque. • Parallel operation of alternators and advantages. • Load sharing in parallel alternators. • Numerical on load sharing of single phase & 3 phase alternators.
3.7	Understand the effect of change in excitation & change in input power (steam supply)	• Effect of change in excitation, effect of change in input power (steam supply)
	UNIT- 4 Single Phase Induction Motor Hrs - 06 Marks-12	
4.1	Explain the double field revolving theory & working principle of single phase I.M.	• Double field revolving theory and working principle of single Phase Induction motor. • Starting of single phase I.M.
4.2	Describe the constructional features of different types of single phase I.M.	• Types of single phase I. M.:- • Split phasing principle and starting of a) Resistance start I. M. b) Capacitor start-run I.M. c) Double value capacitor run induction motor. d) Shaded pole motor.
4.3	Torque- slip characteristics of single phase induction motors & their applications.	• Torque- slip characteristics of above single phase induction motors. • Applications of above motors.

List of Practicals:

Sr. No.	Unit No.	Practicals / Exercise	Hrs. Required
01	01	To identify the various parts of three phase I.M. Also write the function of each part. a) Squirrel cage b) Slip ring.	02
02	01	a) Demonstration of rotating magnetic fields in 3 phase windings when 3 phase supply is given to windings. b) To reverse the direction of rotation of three phase I.M.	02
03	01	To determine the slip of three phase I.M. by a) Direct speed measurement b) Stroboscopic method c) Galvanometer Method	04
04	04	a) Perform load test & determine the performance of given I.M.	02
05	02	Speed control of three phase slip ring I. M. by rotor rheostat control method.	02
06	02	Speed control of three phase I.M. by pole changing method or PWM technique.	02
07	02	a) To perform load test on single phase I.M. or b) To reverse the direction of rotation of single Phase I.M.	02
08	03	To identify various parts of synchronous machine and write the function of each part.	02
09	03	To plot O.C.C of an alternator at a) Change in excitation and same speed b) change in speed and constant excitation.	02
10	03	To determine regulation of an alternator by direct loading at unity and lagging p.f.	02
11	03	To determine regulation of three phase alternator by synchronous impedance method at various power factors.	02
12	03	To determine regulation of three phase alternator by mmf method	02
13	03	To perform synchronization of alternator with infinite bus or another alternator.	02

Note Minimum 10 practicals are to be performed & at least one from each topic.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Three phase Induction Motor.	Class Room Teaching, Lab work, PPT, Industry visit. Animated clips for working of motor other information from web site.
2	Performance of Three Phase Induction Motor	Class Room Teaching, Lab work, PPT, Industry visit. Animated clips for working of motor other information from web site.
3	Three Phase Alternator	Class Room Teaching, Lab work, PPT, Animated clips for working of motor other information from web site. Visit to institute D.G. set.
4	Single Phase Induction Motors	Class Room Teaching, Lab work, PPT, Industry visit, Animated clips for working of motor other information from web site.

Text Books:

Sr. No.	Title	Author	Publication
1	Electrical Technology Vol. II	B.L. Theraja ,	S. Chand and Co. New Delhi
2	Principles of Electrical Machines	Mehta	S. Chand and Co. New Delhi
3	Electrical Machine-I	Gupta J. B.	S. K. Kataria & sons, New Delhi,
4	Electrical Machine	S.K.Bhattacharya	McGraw Hill

Reference Books:

Sr. No.	Title	Author	Publication
2	Electrical Machines	Despande. M.V.	PHI Learning., New Delhi, 2011 or
3	Electrical Technology	Uppal, S.L.	Khanna Publication, New Delhi,
4	Electrical Machine	Nagrath I.J. and Kothari	Tata McGraw Hill, New Delhi, 2011

Learning Recourses:
Class room, Machine Laboratory, PPT presentation, Text books & reference books, Industrial Visit.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Three phase Induction Motor.	04	08	08	20
2	Performance of 3 Phase I.M.	04	08	08	20
3	Three Phase Alternator	04	08	16	28
3	Single Phase Induction Motors	04	06	02	12
	Total	**16**	**30**	**34**	**80**

(Dr. A. R. Phadke)
Prepared By

(Prof. S. V. Chaudhari)
Secretary, PBOS

(Prof. M. A. Chigteri)
Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Testing and maintenance of electrical equipment

Course Code : EE 484

Teaching Scheme:

	Hours/Week	Total Hours
Theory	04	64
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	--	25	--

Course Rationale:

This course is under applied technology level with application in Industry, commercial, public utility departments such as PWD, Irrigation, MSEB, water supply & sewage board etc. After studying this subject student will be able to inspect, test, install & commission electrical machines as per IS and International standards. He / She shall carry out routine & preventive maintenance of electrical machines & possesses knowledge of Indian Electricity Act, safety rules, safety of machines & persons, prevention of accident. This will help him to initiate total productive maintenance.

Course Contents:

SECTION-1		
UNIT-1Testing of Electrical Machines HRS -16 Marks-16		
Major learning outcome		**Topic and subtopics**
1.1	State the objectives of testing.	1. Objectives of testing 1. Significance of Indian Standards 2.Roles of Bureau of Indian Standards (BIS) in testing of electrical equipment's. 1.Types of tests: Routine, type, supplementary & special tests. 2.Methods of testing a) Direct b)Indirect c) Regenerative Tolerance, Tolerances for rotating machines as per IS 4722-2001 , Tolerances for power transformers as per IS 2026 (part-I) -2011 1.Testing of transformer as per IS 2026 (Part-I)-2011 Routine tests, Type tests and Special tests. 2.Tests before commissioning of transformer. 1. Testing of three-phase Induction motor as per IS 4029 : – 2010 and IS 325 – 1996 Routine tests, Type tests and Special tests. • No load test & blocked rotor tests.
1.2	Explain the significance of Indian Standards and role of BIS in testing of electrical equipment's	
1.3	Know the types and methods of testing	
1.4	Know the Concepts of tolerances in testing of equipment as per IS	
1.5	To list and perform tests on transformer as per Indian Standards	
1.6	To list and perform tests on three-phase Induction motor as per Indian Standards Draw a circle diagram and determine the performance of 3	

Head. Engineering Deptt.
Government Polytechnic
Pune 411 016

	Draw a circle diagram and determine the performance of 3 ph. induction motor	• No load test & blocked rotor tests. • Circle diagram from no load test & blocked rotor tests data and performance parameters. • Losses & efficiency.
1.7	To perform tests on single-phase Induction motor as per Indian Standards	1. Testing of single-phase induction motor as per IS 7572-2009.
1.8	To perform tests on Synchronous machine as per Indian Standards	1. Testing of synchronous machines as per IS 7132-1973.
1.9	List the tests to be carried out before installation of electrical equipment.	Mechanical & electrical tests before installation of electrical equipments.
UNIT-2 Maintenance of Electrical Machines Hrs-08 Marks-12		
2.1	Explain the need of maintenance, importance of routine and preventive maintenance. Know safety while doing maintenance.	1. Maintenance, need of maintenance. 2. Types of maintenance:-Routine, preventive & breakdown maintenance. 3. Causes of failure of electrical machines. 4. Preventive maintenance:- Meaning, Importance and advantages of preventive maintenance, Procedure for developing preventive maintenance schedules for electrical machines, Factors affecting preventive maintenance schedules. 5. Break down maintenance and its record keeping. 6. Safety rules applicable for preventive maintenance and breakdown maintenance.
2.2	Prepare maintenance schedules for electrical equipments as per IS	• Maintenance schedules of the following as per I.S.S. 1. Distribution transformer and Power transformer as per IS 10028 (Part-III)-1981 2. Single phase & three phase Induction motors as per IS 900-1992 . 3. Synchronous machines. 4. Transmission lines & feeders. 5. Batteries and inverters. 6. Switchgears like ACBs, MCCB. isolators, CBs, contactors
2.3	Identify different faults due to poor maintenance of electrical equipment.	Different types of faults developed such as mechanical, electrical and magnetic faults due to poor maintenance.
UNIT-3 - Testing & maintenance of Insulation HRS -08 , Marks 12		
3.1	Know the importance & qualities of insulating materials in electrical equipments.	1. Insulation & importance of insulation in electrical equipments. 2. Qualities of insulating materials used in electrical equipments.
3.2	Classify insulating materials	3. Classification of insulating materials as per I.S. 8504(part III) 1994.
3.3	Know the factors affecting life of insulating materials.	1. Factors affecting life of insulating materials.
3.4	Measure I. R. by different methods & interpret the condition of insulation.	1. Measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric absorption, iii) Megger 2. To interpret the condition of insulation 3. Meaning of infinity and zero reading .

3.5	Explain the methods of reconditioning of insulation	Reconditioning of insulation 1. Cleaning of the insulation. 2. Drying of electrical insulation. 3. Re-varnishing & it's different methods.
3.5	What are the agents contaminating of insulating oil. Know the testing of insulating oil as per IS	1. Properties of good insulating oil (transformer oil) . 2. Causes of deterioration of oil. 3. Agents which contaminates the insulating oil. 4. Testing of as per IS 1866-2000 :-Tests on oil as per I.S. 1692-1978 a) acidity test b) sludge test c) crackle test e) flash point test. f) dielectric strength. 5. Methods of purification and filtration of insulating oil
	SECTION-2	
	UNIT- 4: Fault finding and Trouble Shooting, HRS -10, Marks-12	
4.1	State conditions of normal working of electrical equipments & permissible limits electrical parameters for safe working of electrical machines.	1. Normal working of electrical equipments. 2. Permissible limits for safe working of electrical machines in voltage, frequency, current & speed. 3. Effect of variations of above parameters on performance of electrical machines.
4.2	Define and state the significance trouble shooting.	1. Trouble shooting & its significance.
4.3	Know the causes of faults ,different types of faults and Locate faults in electrical machines.	1. Causes of faults and types of faults. 2. Mechanical faults, electrical faults & magnetic faults in the electrical equipments. 3. Reasons for development of above faults in electrical equipments.
4.4	Use various tools for fault finding in electrical machines	1. Tools and equipment used in trouble shooting and repairs:- tools like bearing puller, filler gauges, dial test indicator, spirit level, megger, earth tester, and growler.
4.6	Prepare trouble shooting charts for rotating machines and transformers	1. Common troubles in electrical equipments. 2. Trouble shooting charts for following electrical equipment and machines. • D.C. Machines • AC Machines: 3 phase & 1 phase I.M.& synchronous generator & motor. • Transformers [IS 10028 (Part-III) - 1981] • Underground cables. • Switchgears like ACBs, MCCB. isolators, CBs, contactors
	UNIT-05 Installation of electrical equipments, HRS -12, Marks-14	
5.1	To know the Installation of static and rotating electrical machines .	1. Standard procedure for installation of various electrical machines 2. Inspection on arrival and before installation. 3. Preparation of technical report & specification sheet.
5.2	Use the devices and tools for handling of electrical equipments	1. Tools / instruments required for installation (loading, unloading, lifting, and carrying heavy electrical equipment's). 2. Precautions to be taken while handling them.
5.3	Know the foundation for different electrical machines and effects of factors to be taken in to consideration while doing foundation.	1. Requirements of dimensions of foundation for static & rotating machines. 2. Factors to be taken in to account in designing machine foundations. 3. Foundation preparation for installation.

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

		4. Procedure of leveling & aligning. 5. Alignment of direct coupled drive and belt & gear drives 6. Effects of misalignment.
5.4	Know requirements for installation of transformer and rotating electrical machines as per IS.	1. Installation of transformer as per IS. 2. Requirements of a) indoor b) pole mounted transformers. 3. Requirements of installation of rotating electrical machines as per IS . 4. Requirements for installation of over head transmission lines and underground cables. 5. Requirements for installation of control panels, bus-bars & switchgears.
5.5	Know the importance of safety precaution while installation.	1. Safety precautions & their importance while working on electrical installations.
UNIT-06 Prevention Accidents and Safety Precautions, HRS-10,MARKS-14		
6.1	Know acts & rules regarding safety of persons & equipments.	1. I.E Act & statutory regulations for safety of persons & equipments followed while working on electrical installations. 2. General safety practices in electrical work.
6.2	Know the types and causes of electrical accidents.	3. Types and causes of electrical accidents.
6.3	Follow electrical safety measures while working on electrical installations.	1. Preventive measures against electrical accident. 2. General and specific safety rules to avoid electrical accident as per I.E. acts. 3. Safety signs and symbols used in industry. 4. Do's & don'ts regarding safety while working on electrical installations.
6.4	Rescue electrocuted person and follow artificial respiration methods	1. Electrical shocks and factors affecting the its severity. 2. Method of rescuing electrocuted person & different methods of artificial respiration. 3. Importance of "permit to work" in power station and electrical installation. :-Concept of Permit system, its preparation & regulation for attending to electrical work.
6.5	To know causes of fire, chemistry of fire & use of fire extinguisher.	1. Safety tools and devices with their applications like Slogan, Board, Notice, Fire extinguisher. 2. Chemistry of fire & causes of fire. 3. Precautions to be taken to avoid fire due to electrical reasons. 4. Different types fire extinguishers.

List of Practical's:

Sr. No.	Unit No.	Tutorial/Exercise	Approx. Hrs. Required
01	01	To perform the polarity & phasing out test on 3 phase transformer.	02
02	01	a) To perform test to determine the magnetising current & core loss of single phase transformer. b) To perform test to determine the impedance & copper losses of single phase transformer	02
03	01	a)To determine regulation and efficiency of single-phase transformers by back-to-back connection.	02

Head. Engineering Deptt.
Government Polytechnic
Pune 411 016

		b) To determine the temperature rise in 3 phase transformer by any one method.	
04	02	Visit to DG Set and prepare maintenance scheduled of it.	02
05	03	To determine breakdown strength of transformer oil.	02
06	03	To measure winding resistance and insulation resistance of transformer & a. c. rotating machines.	02
07	04	To perform no load and blocked rotor test on 3 ph induction motor and draw circle diagram to determine the performance parameters.	04
08	04	To prepare trouble shooting charts for single phase and three phase Induction motor.	02
09	04	To use different maintenance tools such as bearing puller, growler, dial test indicators, filler gauge, spirit level etc.	02
10	06	To demonstrate the operation of fire extinguisher or film show for the fire fighting.	02

Note:-All TEN practicals from above list at to be performed in the laboratory

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Testing of Electrical Machines	Class room teaching and laboratory work.
2	Maintenance of Electrical Machines	Class room teaching and laboratory work.
3	Testing & maintenance of Insulation	Class room teaching and laboratory work.
4	Fault finding and Trouble Shooting	Class room teaching and laboratory work.
5	Installation and Earthing	Class room teaching and laboratory work.
6	Electrical Accidents and Safety	Class room teaching and laboratory work.

Text Books:

Sr. No.	Title	Author	Publication
1	Testing, installation & Maintenance of Electrical Equipments.	B.P. Patil	Vrinda Publication.
2	Operation and maintenance of electrical Machine Vol.-I & Vol. -II	B.V.S. Rao	Khanna Pub. New Dehli.

Reference Books:

Sr. No.	Title	Author	Publication
1	Electrical Technology Vol. I and II	B.L.Theraja	S. Chand & Sons.
2	Preventative Maintenance Hand Book & journals.	C.J.Hubert	
3	Performance of AC machine.	M.G. Jay	
4	Electrical Engineering	M.A.Chaudhary	Nirali Pub.
5	Industrial Safety	Kulkarni	

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

No.		Knowledge	Comprehension	Application	
		SECTION-1			
1	Testing of Electrical Machines	04	06	06	16
2	Maintenance of Electrical Machines	04	04	04	12
3	Testing & maintenance of Insulation	02	04	06	12
	Total (Section-1)	10	14	16	40
		SECTION-2			
4	Fault finding and Trouble Shooting	04	04	04	12
5	Installation of electrical equipments.	04	06	04	14
6	Prevention Accidents and Safety Precautions	04	06	04	14
	Total (Section-2)	12	16	12	40

Mrs.U.S.Tulangekar
Prepared By

S.V. Chaudhari
Secretary, PBOS

Prof.M.A.Chigteri
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Switchgear and protection

Course Code : EE 485

Teaching Scheme:

	Hours/Week	Total Hours
Theory	04	64
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	--	25	--

Course Rationale:

Presently electrical power system is growing fast due to increasing industries, needs, population .A diploma pass out may have to work in the field of generation, transmission distribution maintenance, testing .So the student must know about the switchgear& protection. It is expected that the knowledge of facts, concepts, principles and procedural aspects of switchgear and protection system must be known to the students it will ultimately help the students in discharging their duties such as technicians, engineer in power house, substation, testing service sectors.

Course Contents:

SECTION-1		
Major learning outcome		Topic and subtopics
UNIT-1 Fundamentals of Protection HRS -05 Marks-06		
1.1	Aware of the need and function of protection system.	• Necessity and functions of protective system. • Primary and back up protection.
1.2	Differentiate between the normal & abnormal conditions of power system.	• Normal & abnormal conditions,
1.3	List the types of fault & state their causes	• Type of faults and their causes.
1.4	Determine short circuit current , short circuit KVA	• Short circuit calculations (Numerical on faults only).
1.5	What is the use of current limiting reactors and draw their arrangements?	• Use of current limiting reactors & their arrangements
UNIT-2 Circuit Interrupting Devices HRS -15 Marks-18		
2.1	What is fuse? state its different types and describe their construction and working,	• Fuse: basic terminology w.r.t. fuse, types, Construction, working,
2.2	Enlist the Characteristics of fuses of different types and their applications.	• Characteristics, selection and applications of fuses.

2.3	Explain the necessity of isolators and write its function.	• Necessity and functions of Isolators.
2.4	State the types of Isolators and describe their working	• Types of Isolators:-Vertical break, horizontal break, and pantograph type.
2.3	Describe the process of an Arc formation.	• Arc formation process.
2.4	Understand the various methods of arc extinction and define terms related with it.	• Methods of arc extinction – High resistance method and current zero method. • Definition: Arc voltage, Recovery voltage, Restriking voltage, RRRV.
2.5	Understand the construction, working principle and applications of different types of circuit breakers. To know the sequence of operation & interlocking of CBs, isolators & earthing switch.	• Circuit breakers: - Concept, Classification, Working principle. • Construction, working of principle, Specification & Applications of following circuit breakers. • a) L.T.- Air circuit breakers (ACB), Miniature circuit breakers, Moulded case circuit breaker, Earth leakage circuit breaker . • b) H.T ~~- Air Circuit Breaker~~, Sulpher Hexa Fluoride circuit breaker (SF6), Vacuum circuit breaker.
2.6	Select switchgears as per application & understand the ratings of CBs.	• Selection of switchgears for particular applications. • Ratings of Circuit Breaker.
2.7	To Compare fuse &MCCB	• Comparison of fuse & MCCB
2.8	To know about HVDC circuit breakers	• HVDC CBS: Introduction, problems with arc interruption, HVDC circuit breaker.
	UNIT-3- Protective Relays HRS -12 Marks-16	
3.1	State the need and function of protective relays system	• Necessity, function & single line diagram of protective relay system.
3.2	List the essential qualities of protective relaying & their importance. To know the relay terminology.	• Quality requirements of relay system: selectivity, speed, sensitivity, reliability, and simplicity, economy: meaning of the term and its significance in protective relaying. • Basic Relay Terminology: - Protective relay, relay time, reset time, pick up value, reset value, Auxiliary relay.
3.3	Classify various types relays	• Classification of relays based on terminology used, principle of operation, times of operation, functions, protective schemes, characteristics.
3.4	Understand the working principle, Characteristics, and application of different types of relays.	• Characteristics, working principle & applications of following relays: Electromagnetic relay(Hinged armature type only),induction disc relay, thermal relay, • Static Relays: Introduction, advantages & disadvantages of static relays. • Numerical Relays: Introduction, general block diagram, classifications of numerical relays. Advantages & disadvantages of numerical relays.

		• Comparison among the above relays.
3.5	Understand the operation of over current relay. Understand the PSM & TSM and its effects on characteristics.	• Over current relay: - Time current characteristics & its classifications. • Current setting, plug setting multiplier (PSM) ,Time setting multiplier (TMS) • Numerical on PSM &TMS. • Static over current relay with all types. • Numerical over current relay (µC based) with block diagram, flow chart.
	SECTION-2	
	UNIT-4 Protection of Alternator HRS -06 Marks-08	
4.1	To know various faults and Abnormalities of alternator.	• Abnormalities and faults in alternators.
4.2	Understand the protection schemes of alternator against different types of faults.	• Differential protection, biased differential Protection, Protection against prime mover failure, field failure and unbalanced load, restricted earth fault protection, over current, inter turn fault, over heating protection, over voltage & motoring action.
4.3	To know the concept of reverse power protection	• Concept of power protection when it happens. • Directional relay: electromagnetic & numerical (µC based with block diagram & flow chart only) types.
	UNIT-05 Protection of Transformer HRS -06,Marks-08	
5.1	Identify various faults & abnormalities of transformer	• Abnormalities & faults in transformers,
5.2	Understand the various protection schemes of transformer	• Differential and Biased differential protection. • Limitations of differential protection of transformer • Simple numerical on differential protection. • Over current, Earth fault, inter turn, over heating protection.
5.3	Understand the Importance of Buchholz Relay	• Buchholz relay: construction, working principle & its installation location.
	UNIT-06 Protection of Induction Motor HRS -03,Marks-04	
6.1	Identify various faults & abnormalities of I.M.	• Abnormalities and faults in induction motors.,
6.2	Identify various protection provided for motors. Observe the behaviour of protective devices provided for motor.	• Protections against following faults in motor. • Short circuit & earth fault. • Over load protection. • Single phasing.
	UNIT-07 Protection of Bus bar & Transmission Line HRS -07,Marks-08	
7.1	Identify the faults & abnormalities of Transmission lines	• Abnormalities & Faults on transmission lines.
7.2	Understand the working principle of distance & pilot wire protections.	• Distance Relay: working principle, electromagnetic type, static and numerical (µC based with block diagram & flow chart only) types. • Pilot wire protection of transmission lines: a) working principle of current circulating & balanced voltage b) carrier current protection.
7.3	Understand the Distribution line	• Distribution line: Over current protective scheme for

	Protection scheme & auto reclosing.	feeders. • Auto-reclosing.
7.5	Understand the Protection scheme for Bus Bar.	• Bus Bar Protection: Faults & Operation of Differential Protection.
UNIT-08 Over Voltage Protection and Neutral Earthing HRS -10,Marks-12		
8.1	State the causes of over voltage	• Causes of over voltages. • Lightening Phenomena & over voltage due to lightening its wave shape.
8.2	To know the protection from direct stroke and travelling wave of power system equipments.	• Protection of transmission line and substation from direct stroke. • Protection against traveling wave
8.3	List types of lightning arrester	• Types of lighting arresters 1) Rod Gap 2) Horn Gap 3) Expulsion 4) Thyrite Type 5metaloxide surge arrester.
8.4	State the need and function of surge absorbers	• Principle & operation of surge absorbers
8.5	Understand the insulation co-ordination & BIL.	• Insulation co-ordination and BIL
8.6	Understand the importance of Neutral earthing & its types,	• Introduction & importance Neutral earthing. • Types of neutral earthings. • Substation earthing.
8.7	Distinguish between equipment earthing and neutral earthing	• Difference between Equipment earthing and Neutral earthing

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
01	To plot operating current-time characteristics of fuse	02
02	Visit to L & T Switchgear Training Centre and write visit report comprising function, working operation, testing & maintenance of MCB, ELCB, MCCB and Contactor.	04
03	Drawing sheet on circuit breakers – MCB, ELCB, SF6 Circuit Breaker and Vacuum Circuit Breaker.	02
04	Setting of thermal overload relay and plot the characteristics of thermal overload relay.	02
05	Drawing sheet on Relays:–Electromagnetic Relays (Any Two), Induction disc type Relay, Thermal Relay, Buchholz Relay.	02
06	Demonstration & Testing of static a) over current /under current relay. b)Under voltage & over voltage relay. c) Phase failure relay.	06
07	Drawing sheet on Protection Schemes of Alternator in AutoCAD: - biased differential Protection, restricted earth fault, unbalanced load.	02
08	Drawing sheet on Protection Schemes of Transformer in AutoCAD: - biased differential Protection, earth fault.	02
09	Connect MCB, DOL starter & single phase preventer in I.M. circuit and check operation for short-circuit, overload & single phasing faults.	02

10	Visit to high voltage substation & draw single line diagram of substation. State function & technical specification of equipments used therein.	04
11	Drawing Sheet on Lightening Arresters – Rod Gap, Horn Gap, Expulsion Type, Thyrite Type, metaloxide type.	04

Note:-Minimum TEN practical's from above list at list one on each topic to be performed in the laboratory

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION-I	
1	Fundamentals of Protection	Lecture, discussion
2	Circuit Interrupting Devices	Lecture, PPT, Q/A, industrial visits
3	Protective Relays	Lecture, discussion
	SECTION-II	
4	Protection of Alternator	Lecture, models, PPT, industrial visits.
5	Protection of Transformer	Lecture,PPT, industrial visits.
6	Protection of Induction Motor	Lecture,PPT, industrial visits.
7	Protection of Bus-Bar and Transmission line	Lecture,PPT, industrial visits.
8	Over Voltage Protection and Neutral Earthing	Lecture,PPT, industrial visits.

Text Books:

Sr. No.	Title	Author	Publication
1	V.K.Mehta	Principle of Power system	S. Chand & co New Delhi
2	Badriram Vishwwakarma	Power system protection & switch gear	TMH New Delhi

Reference Books:

Sr. No.	Title	Author	Publication
1	Switchgear and protection	Sunil S. Rao	Khanna Publishers,Delhi.
2	A course in Electrical Power	S.L.Uppal	Khanna Publications Delhi
3	The art and science of protective relay.	Mason C.R.	

Learning Recourses: class room lecture, animated images or static images from web site,Industrial visits, and Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
		SECTION-I			
1	Fundamentals of Protection	02	00	04	06
2	Circuit Interrupting Devices	04	12	02	18
3	Protective Relays	04	08	04	16
	Total (SECTION-1)	10	20	10	40
		SECTION-II			
4	Protection of Alternator	02	04	02	08
5	Protection of Transformer	02	04	02	08
6	Protection of Induction Motor	02	00	02	06
7	Protection of Bus-Bar and Transmission line	02	04	02	08
8	Over Voltage Protection and Neutral Earthing	02	04	06	12
	Total (SECTION-2)	10	16	14	40

(Prof.J.D.Naik,Prof.K.M.Kakade)
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Estimation and Costing

Course Code : EE 486

Teaching Scheme:

	Hours/Week	Total Hours
Theory	02	32
Tutorial	01	16
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	--	25	--

Course Rationale:

The diploma holder of electrical engineering generally works on residential, commercial and industrial electrical installation or he may become entrepreneur in field of contracting Or electrical installation after some experience. In the above field, he has to supervise the Site, manage the right materials at right time at site. He also works as estimator in above field. To fulfil the above requirement, he has to select the proper residential, commercial and industrial wiring accessories and materials, prepare their estimates with their costs. He must know the general procedures for such installation, estimation and costing, he can apply these procedures in different situations and for different purposes.
The topics covered in this course are general illumination, general principle of estimation, service connections, earthling, residential wiring, commercial, industrial wiring and quotation & tender.

Course Contents:

Section-1		
UNIT-1 Elements of Estimating and Costing HRS -02 Marks-06		
Major learning outcome		Topic and subtopics
1.1	Define Estimation and Costing . To know the purchase system of organisation. To know the function & qualities of estimators.	• Definition of "Estimation" & costing • Types of estimation and estimation tools. • Overhead and service charges. • Purchase procedure • Purpose of estimating and costing. • Qualities of good estimator. • Essential elements of estimating and costing.
UNIT-2 Electrical Wiring and Drawings HRS -02 Marks-04		
2.1	Give the classification of electrical installations.	• Classification of electrical installations.

2.2	State and explain general requirements of electrical installation.	• General requirements of electrical installation.
2.2	Draw and interpret civil and Electrical drawings & symbols.	• Reading & interpretation of civil and electrical engineering drawings & symbols related to installations. • Representation of different types of diagrams, such as schematic, circuit, wiring diagram and its single line representation as per IS code.
2.4	State and explain IE rules related to electrical installation for wiring and Electricity supply act-1948.	• IE rules related to electrical installation for wiring, including Electricity supply act-1948.
UNIT-3 Service connections HRS -02 + 02(T) Marks-06		
3.1	Define Service Connection	• Concept of Service connections.
3.2	Select appropriate method for service connection with their features.	• Types of service connections and their features. • Differentiate between underground and overhead service connection.
3.3	To determine the material schedule(BOM) for various service connections & know procedure of installation.	• Material schedule for different type's service connections. • Methods of installation of service connection.
3.4	Know IE rules w.r.t. service connections.	• I.E. rule for service connections.
UNIT-4 Residential Installation HRS -05 + 03(T) Marks-12		
4.1	Select wires and wiring methods as per the requirement	• Review of wiring accessories in view of its purpose and specifications.
4.2	Understand the requirement of electrical installation.	• Requirement of electrical installations such as civil plan, customer requirement and I.E. rules.
4.3	Able to design residential installation as per IS.	• Design of residential installation. 1. General guidelines for residential installations. 2. Electrical plan layout. 3. Single line diagram. 4. Schematic wiring diagram. 5. Distribution of load as per I. E. Rules. 6. Size of wires, selection of wires , Selection of rating for main switch, distribution board ,MCB,ELCB, fuses and wiring accessories.
4.4	Able to prepare total estimation and costing of residential installation.	• Estimation and costing of residential electrical installation 1. Total estimation and costing of overall residential installation with proper cost of material , labour charges , contingencies charges.
4.5	To state the purpose of earthing and types of earthing and determine length and size of earth wire. To know the IS. To determine the material schedule of earthings.	• Earthing and its types. • Indian Standard specifications regarding earthing of electrical installations. • Earth resistance & methods reducing earth resistance. • Prepare material schedule for earthing. (Item,

		specifications, qty, rate and total amount etc.). • I.E. rules for earthing. • Factors affecting the length and size of earth wire & earthing electrodes.
UNIT-5 Electrical Installation for commercial building Hrs-05 + 3(T) Marks-12		
5.1	Define commercial installation and differentiate it from residential installation	• Concept of commercial installation. • Difference between residential and commercial installation.
5.2	State guidelines for commercial installation.	• General requirements and selection factors for commercial installation. • Load calculation and selection of size of service connection and nature of supply. • Decide number of lighting and power sub circuits as per the IE rule.
5.3	Draw a circuits, sub circuits and single line diagram and collect various specifications of wiring material. To determine the load distribution, material schedule & costing of commercial installations.	• Draw the single line diagram ,circuits, sub circuits for commercial installation. • Decide size of wire/cable required for every sub circuit. • Decide length of wire required for every sub circuit. • Decide ratings of wiring accessories, main switch, bus bar MCB, ELCB etc. • Decide proper method of earthing for commercial installation. • Prepare list of material for commercial installation with their costing.
5.3	To aware of testing of installation.	• Testing of installation as per IS
SECTION-2		
UNIT-6 - Industrial Installation HRS -04 + 03(T) Marks-12		
6.1	Understand the guidelines for industrial installation.	• Guidelines for industrial installations. • Power wiring for motors or any industrial loads. • Supply distribution in power wiring.
6.2	Design industrial installation & Prepare estimation for different ratings, size & other technical specification and draw single line diagram for electrical installation in small industries.	• Design consideration for electrical installation in small industries, Motor current, selection and size of cable, size of conduit, fuse rating, selection of starter, distribution board, main switch and other relevant materials. • Plan layout, single line diagram, wiring diagram, material schedule, Estimation and costing of industrial wiring.
UNIT-7 Overhead and underground distribution lines (Feeders) HRS -05 + 03(T) Marks-14		
7.1	Aware about the materials of HT /LT feeders.	• Review distribution line components in view of its specifications, Materials used in H.T. (11KV) & L.T. (415V) distribution lines.
7.2	understand the design parameters of overhead distribution lines /feeders	• Design consideration of overhead distribution lines /feeders

7.3	Prepare estimation and costing overhead of distribution lines /feeder	• Estimation and costing of overhead distribution lines / feeders.
7.4	Understand the guidelines for design and Prepare estimation and costing of Underground cables.	• 1. Underground cables (H.T. & L.T.), Design consideration of underground cables, Underground cable for street lighting. Estimation and costing of underground cable feeders.
	UNIT-08 Substation HRS -02 + 02(T) ,Marks-06	
8.1	State the types of substations from installation point of view.	• Types of substations – pole mounted substations, indoor& outdoor substations(up to 11,22,33Kv only).
8.2	Prepare estimation and costing for substation.	• Estimation and costing of above substations.
	UNIT-09 Tender and Quotation HRS -05, Marks-08	
9.1	Understand Tender and Quotation terminology	• Definition of different terms such as earnest money, security deposit, warranty period, contract agreement, scope of work & related taxes such as service tax, VAT etc.
9.2	Prepare a quotation with the reference to purchase requisition.	• Quotation – requisition, call of quotation, opening of quotation, comparative statement, purchase order.
9.3	To understand tendering procedure and Filling tender.	• Tender – procedure to prepare tender document, floating of tender, terms and conditions, filling of tender, (Item wise/tender wise), e-tendering.
9.4	Differentiate between tender and quotation.	• Difference between quotation and tender.

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
1	Collect the catalogs of wiring accessories & protective devices and determine information related to estimation of electrical installation.	04
2	Estimation & costing of electrical installation for 1 or 2 BHK flat.	04
3	Study of service connection for residential building and prepare material schedule as per I.E. rules.	04
4	Estimation of materials required for installation of a 1.5 ton air conditioner.	04
5	Estimation & costingof electrical installation for commercial complex up to 250 Kw connected load.	04
6	Estimation & costing of electrical installation for a workshop (Light and power).	04
7	Estimation & costing of electrical H.T. Or L.T. overhead feeder.	02
8	Estimation & costing of electrical H.T. Or L.T. underground cable feeder.	02
9	Case study –To prepare quotation, call quotation, make comparative statement etc. OR Collect tender notice from newspaper, study tender document and fill tender form.	04
	Total	32

Note: 1) Any Eight experiment from above list to be perfomed.
2) For completing term work, necessary layouts /single line diagrams / design drawing must be drawn in AutoCAD.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Elements of Estimating and costing	Lecture methods.
2	Electrical Wiring and Drawings	Lecture methods.
3	Service Connection	PPT presentation, Lecture methods, assignments, numerical & site visit.
4	Residential Installation	PPT presentation, Lecture methods, assignments, numerical & site visit.
5	Electrical Installation for commercial building.	PPT presentation, Lecture methods, assignments, numerical & site visit.
6	Industrial Installation	PPT presentation, Lecture methods, assignments, numerical & site visit.
7	Overhead and underground distribution lines(feeders)	PPT presentation, Lecture methods, assignments, numerical & site visit.
8	Substation	PPT presentation, Lecture methods, assignments & site visit.
9	Tender and quotation	PPT presentation, Lecture methods, case study.

Text Books:

Sr. No.	Title	Author	Publication
1.	Electrical Estimating & Costing	Surjit Singh	Dhanpat rai & co. Delh

Reference Books:

Sr. No.	Title	Author	Publication
1	Electrical Design Estimating & costing	K.B. Raina & S.K. Battacharya	New age international Pub.
2	Tender documents. E-tendering	----------	Any Big organisation such as railway/ PMC/PCMC.
3	----------	PWD hand book,Rate Contract Book.	

Learning Recourses:

Visit to residential or industrial installation site, Visit to substation & feeder site, PWD DSR, Market survey for electrical materials, Reference books

Specification Table :

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION-1				
1	Elements of Estimating and costing	06	00	00	06
2	Electrical Wiring and Drawings	02	02	00	04
3	Service Connections	02	02	04	06
4	Residential Installation	02	04	06	12
5	Electrical installation for commercial building.	02	02	06	12
	Total (section-1)	14	10	16	40
	SECTION-2				
6	Industrial Installation	02	04	06	12
7	Overhead and underground distribution lines(feeders)	02	04	08	14
8	Substation	02	00	04	06
9	Tender and quotation	04	04	00	06
	Total (section-2)	10	12	18	40

(Prof.J.D.Naik,Prof.K.M.Kakade)
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Elect. Engineering Dept.
Government Polytechnic
Pune 411 016

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Utilization of Electrical Energy

Course Code : EE 487

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	--	25	--

Course Rationale:

Electrical energy is the most widely used form of energy by human being. It is used in every walk of life whether it is home, office, industry or farm. It is being used for lighting, heating, refrigeration, cooking, air conditioning, operating machines/computers, welding, traction, irrigation and so on. One important aspect of electrical system is utilization of electrical power. In this era of energy crisis it is must to utilise electricity efficiently. Every diploma electrical engineer therefore should know to operate and maintain main electrical utilities for their efficient operations. This course will enable the students to develop skills to maintain /troubleshoot various electrical equipment / gadgets/appliances in domestic, commercial and industrial sector. The students will be able to make proper selection of equipment according to requirement to ensure economical and efficient use of electricity.

Course Contents:

SECTION-1		
UNIT-1 Illumination HRS -08 Marks-12		
Major learning outcome		Topic and subtopics
1.1	Define various illumination terms and their units .	1. Illumination terminology: • Illumination, light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Lux, Lamp Efficiency, Specific consumption, brightness, Glare. • Space-height ratio, Utilization factor, Maintenance factor, Absorption factor, Reflection Factor. • Solid angle
1.2	State & explain the laws of illumination and its significance.	• Law of Inverse Squares and Lambert's Cosine Law • Numerical.

1.3	Describe the working and applications of the various lamps and fittings.	1.Working and applications of following lamps • Fluorescent Tube &stroboscopic effect. • High Pressure Mercury Vapour (HPMV) Lamps • High Pressure Sodium Vapour(HPSV) Lamps • Compact Fluorescent Lamps (C.F.L.), • Halogen Lamps • Metal Halide lamp • LED lamps.
1.4	State lighting scheme & the factors to be considered while designing good lighting scheme.	• Types of lighting scheme. • Design consideration of lighting scheme such as standard illumination level for different applications, uniformity of illumination, colour of light, shadows, glare, mounting height, spacing of luminaries, colour of surrounding walls, selection of luminaries, size of room, condition of use.
1.5	Know the requirements good industrial lighting, fittings and compare among different schemes.	• Factory lighting: general requirements, local lighting, emergency lighting, . • Industrial lighting fittings. • Comparison of industrial lighting schemes using different lamps.
1.6	Design illumination for different purpose.	• Design of illumination scheme by watts per sq. meter method, lumen method & Inverse square law method. • Design of street lighting and flood lighting. • Flood lighting considerations & its design. • Numerical on above schemes.
Unit 2:Electrical Heating and Welding HRS-10 Marks-16		
2.1	State the advantages and types of electric heating	• Electric Heating, Advantages & Types of electric heating.
2.2	Explain the principle of resistance heating & design heating element.	• Resistance heating & its types. • Heating element materials & their properties. • Causes of failure of heating elements. • Design of heating element & numericals. • Temperature control of resistance oven.
2.3	Explain the principle of arc heating and describe the working of arc furnaces.	• Principle of arc heating. • Types of Arc furnaces & applications.
2.4	Explain the principle of induction heating and describe the working of induction furnaces .	• Principle of Induction Heating. • Types of Induction furnaces, advantages & disadvantages of each type & applications.
2.5	Explain the principle of high frequency eddy current and dielectric heating.	• Principles of high frequency eddy current and dielectric heating. • Advantages, disadvantages and applications of above.
2.6	State the importance welding and advantages & disadvantages of welding.	• Electric welding & advantages & disadvantages of welding. • Classification of welding processes. • Quality of a good weld, welding defects.
2.7	Explain the principle resistance welding , types of resistance welding & list out applications.	• Principle of resistance welding. • Types of resistance welding and application of each type.
2.8	Explain the principle of electric arc welding and its types	• Principle of electric arc welding. • Types of arc welding.

2.9	Know quality of welding & types of electrodes.	• Requirements of good welding, preparation of work & electrodes.
2.10	Know the welding equipments and compare dc & ac welding, resistance & arc welding.	Electric welding equipments. • DC & AC welding set with specification. • Arc welding with ac & dc with specification. • Comparison between dc & ac welding, • Comparison between resistance & arc welding.
Unit 3:Electric Drive HRS-06 Marks-12		
3.1	Know an electric drive & its types.	• Electric drive:- introduction, group & Individual drive.
3.2	Explain the factors governing selection of electric motors as drive. Determine the type & type of motor for particular application.	• Electrical characteristics, Mechanical factors, Nature of load torque, Service capacity & rating, appearance and cost consideration. • Advantages of electrical drives,. • Characteristics of loads. • Different types of mechanical loads. • Characteristic of different drives. • Selection of drives for particular applications. • Types of enclosures. • Types of duty cycles, ratings of motor • Simple numerical on selection of size of motor by using duty cycle.
SECTION-2		
Unit 4: Elevators HRS-04 Marks-08		
4.1	Classify various types of elevator machines and their motors.	• Types of electric elevator machines and their motors. • Size and shape of elevator car, speed of elevators, location of elevator machine. • Power transmission gears and braking
4.2	State the salient features of the latest Lift and elevator Act.	• Safety in elevators. • Requirements of lift installation as per law. • Bombay Lift Act
Unit 5: Electric Traction HRS-16 Marks-26		
5.1	State the traction systems in our country & advantages of electric traction.	• Traction systems. • Advantages of electric traction and electric drive. • Electrical traction system in India.
5.2	Know the different types of track electrification with their advantages, disadvantages.	• Systems of Track electrification- Description of various systems e.g. • DC systems. • Single phase AC system. • Three phase AC system and composite system. • 25 KV A.C.,50 Hz systems, advantages and disadvantages • Comparison between A.C. and D.C. system.
5.4	Understand the speed -time curve of train movement and determine the related terms.	• Typical speed-time curve & related terms. • Factors affecting schedule speed. • Simple numericals • Mechanics of train movement- coefficient of adhesion, tractive effort, gradient.

5.5	Understand the specific energy consumption , discuss various factors affecting on it and determine energy consumption.	• Specific energy output using speed -time curve. • Factors affecting specific energy consumption of an electric train.
5.6	Explain power supply arrangement for traction system and explain the function of various components of traction system.	• Power supply arrangement: • High voltage supply, constituents of supply system, substation, feeding post, feeding and sectioning arrangement. • Protection system for A.C. traction. • Overhead equipment (OHE): – Catenary construction, OHE supporting structure. • Current collection system, conductor rail system, current collectors for overhead system, pantograph collector.
5.6	State the factors governing selection of electric motors for traction application.	• Traction Motors – requirements of motors for traction purpose. • Suitability of following motors for traction purpose. D.C. series, A.C. series, 3 phase I.M., linear I.M.
5.7	Explain the control of traction motors	• Traction motor control: D.C series motor control, series/parallel starting & control, advantages of series-parallel,(No energy diagram, no derivative) speed control by field weakening.
5.8	Know the braking system of an electric train.	• Braking of electric traction: Plugging , dynamic & regenerative braking • Advantages & disadvantages of regenerative braking. • Mechanical braking
	UNIT-6 Domestic Electrical Appliances Hrs-04 Marks-06	
5.1	Explain the working of various domestic electrical appliances.	Working of following domestic electrical appliances: • Microwave oven. • Washing Machine. • Vacuum Cleaner. • Air conditioner

List of Practical's:

Sr. No.	Tutorial/Exercise	Approx. Hrs.Required
01	Measure Illumination at different places in college premises by luxmeter.	02
02	Design illumination scheme for commercial complex. (students may try to use illumination software)	04
03	Design illumination scheme for street lighting	02
04	Prepare a survey report after collecting technical information of various lamps available in the local market & compare them on technical aspect.	04

05	Visit to a medium size manufacturing industry and Prepare a report on following: • Draw the plant layout of industry and earmark for different functioning in industry. • The heating procedure. • Specification of various heating furnaces / equipment used in industries.	02
06	Visit to a industry having welding processes and Prepare a report on following: • Draw the plant layout of industry and earmark for different functioning in industry. • different welding processes. • List out the welding equipments & their specification.	02
07	To determine the type & size of a motor for following application & specific load condition. (Any one) • Water lifting pump. • Elevator • Saw mill. • flour mill. • Concrete mixer.	02
08	Visit to elevator installation site and Prepare a report on following aspect. • Type & size of elevator. • Car size , rope & balance weight. • Motor size. • Control sensors & switches. • Controller & control panel.	04
09	Visit to traction substation a.c./d.c. and draw single line diagram of s/s using Auto Cad and write a report on visit.	04
10	Demonstration of following (any two) domestic appliances for different components , their functions with energy consumption and procedures for basic testing and maintenance. Also study of their specification and costs. • Microwave oven. • Washing Machine. • Vacuum cleaner. • Air conditioner	02
10	Visit to servicing centres of any electrical domestic appliances and write the report on following aspects. • Method of documentation. • Servicing procedure and workshop. • Qualification & skills of service technicians. • Billing and accounting.	04
	Total	32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Illumination	Lecture ,site visit, market survey, PPT Q/A.
2	Electrical Heating and Welding	Lecture ,PPT, Q/A, industrial visit.
3	Electric Drive	Lecture ,PPT, Q/A, industrial visit, case study.
4	Elevators	Lecture ,PPT, Q/A, industrial visit, case study.
5	Electric Traction	Lecture ,PPT, Q/A, industrial visit.
6	Domestic Electrical Appliances	Lecture ,site visit, market survey, PPT & Q/A.

Text Books:

Sr. No.	Title	Author	Publication
1	Art & Science of Utilization of Electrical Energy	H.Partab	Dhanpat Rai & Sons
2	Utilization of Electric Power & Electric Traction	J.B.Gupta	S.K.Kataria & Sons
3	Fundamentals of Electrical Drives	G. K. Dubey	Narosa Publishing House. New Delhi, Latest edition
4	Electrical Power system	V.K.Mehta	S.Chand, New Delhi, Latest edition

Reference Books:

Sr. No.	Title	Author	Publication
1	Utilization of Electric Power & Electric Traction	G. C. Garg	Khanna Publishers, New Delhi, Latest edition
2	Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publisher Ltd., New Delhi, Latest edition

Learning Recourses :

1. Chart 2. Black Board 3.Television 4. Internet 5. Educational CD's

6. Models 7. Experimentation 8. Diagram Demonstration

Elect. Engineering Deptt.
Government Polytechnic
Pune - 1 016

Specification Table :

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
		SECTION-1			
1	Illumination	04	04	04	12
2	Electrical Heating and Welding	04	06	06	16
3	Electric Drive	04	04	04	12
	Total (Section-I)	12	14	14	40
		SECTION-2			
4	Elevators	04	04	00	08
5	Electric Traction	06	10	10	26
6	Domestic Electrical Appliances	02	02	02	06
	Total (Section-2)	12	16	12	40

(Prof.J.D.Naik,Prof.K.M.Kakade)
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Energy Audit and Conservation

Course Code : EE 488

Teaching Scheme:

	Hours/Week	Total Hours
Theory	03	48
Term Work/Practical	02	32

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs	--	--	---
Marks	20	80	--	25	--

Course Rationale:

Energy is the basis of human life. The energy being a major requirement of society, hence the study of today's energy need, present energy scenario and strategy for future are essential. The energy development and management carries a lot of significance in today's education. At the same time growing demands and shrinking of recourses is giving rise to situation of energy crisis. To overcome the present situation, knowledge of energy conservation is essential. For monitoring effectiveness of energy conservation methods and proper use of electrical energy in different areas, energy audit is must. Every electrical engineer must also be aware of social concern related to energy utilization.

Course Contents:

SECTION-1		
UNIT-1 Motives of Energy Conservation And Management: HRS -03 , Marks-04		
Major learning outcome		Topic and subtopics
1.1	Classify Energy & identify the need of Energy Conservation	• Classification of energy. • Energy needs of growing economy
1.2	Know the concept of energy conservation & explore for act.	• Conservation of electrical energy. • Energy conservation potential in different areas. • Energy conservation Act 2001, its amendments & its features.
1.3	Know the functioning of Government & NGOs working on energy conservation and management.	• Government organization and non- Government organization working on energy conservation & management. • Power qualities. • Concept of energy intensity, energy security & energy efficiency.
UNIT-2 Energy Conservation Techniques in Electrical System: HRS -11 , Marks-18		
2.1	Know energy conservation techniques in lighting system.	• Use of right sources of lamp for different applications. • Improved illumination design by use of energy efficient light sources. • Guidelines for energy efficient lighting system.

		• Energy saving potential in street lighting with efficient design & lamps.
2.2	State and explain various methods of energy conservation techniques for improving the performance of motor.	• Energy conservation in motor. • Various energy conservation techniques in Induction motor 1. Improving Power quality. 2. Improving power factor. 3. Motor survey. 4. Size of motor as per load. 5. Minimizing the idle and redundant running of motor. 6. Operating in star or delta mode as per load. 7. Rewinding of motor. 8. Improving mechanical power and transmission efficiency.)
2.3	Understand the features, applications & energy saving potentials of Energy Efficient Motor(EEM).	• Energy Efficient Motor (EEM):- Definition, constructional features, design considerations and applications of EEM. • Determination of cost effectiveness, implementation of motor management programme. • Energy saving starters such as soft starters / VVFD or VFD for three phase I.M. • Energy efficient speed control system & Multispeed motors. • Comparison of EEM with conventional Induction motor.
2.4	State and explain various methods of energy conservation for improving the performance Transformer.	• Energy conservation in transformer. • Methods to improve the performance of transformer. • Energy conservation methodologies in transformers. • Review of energy efficient transformers.
2.5	Know the losses and opportunities of energy saving in transmission and distribution of electrical power.	• Review of transmission and distribution losses. • Different methods of energy saving in transmission and distribution system on following points 1. Reducing I^2R losses. 2. Compensating reactive power. 3. Improving power factor of utility & consumers. 4. Selection of capacitors. 5. Optimizing distribution voltage. 6. Balancing phase currents. 7. Use of energy efficient Transformers and switchgears. 8. Energy conservation techniques related to commercial losses.
UNIT-3 Energy Conservation in Electrical & Thermal Utility Systems :Hrs-10, Marks-18		
3.1	State & explain the losses in furnaces and techniques of energy conservation in heating systems.	• Furnaces: Types & classification. • Furnace losses & Characteristics of efficient furnace. • General fuel economy measures in furnace, utilizing waste heat as a heat source of other processes, minimization wall losses. • Various energy saving opportunities in furnace

		and oven.
3.2	State the various energy saving opportunities in pumping system.	• Energy conservation opportunities in pumping systems.
3.3	State the energy saving opportunities in fans, blower & compressors.	• Energy saving opportunities in the fans, blowers and compressors.
3.4	State the energy saving opportunities in alternative sources of energy.	• Energy saving opportunities in alternative sources of energy such motive power (i.e. battery) & captive generation (DG set).
3.5	Energy saving opportunities in refrigeration system.	• Energy saving opportunities refrigeration system.
3.6	Energy saving opportunities in air conditioning system.	• Energy conservation in air conditioning system.
	SECTION-2	
	UNIT- 4 - Economics of Energy Conservation HRS -06 , Marks-10	
4.1	Understand economics of energy conservation and related terminologies.	• Simple payback period analysis. • Advantages & limitations of payback period. • Time value of money, net present value method, internal rate of return method, and profitability index for benefit cost ratio.
4.2	Know the different types of tariffs & suggest appropriate tariff with respect to applicability & load, Also analyze impact of tariff on electricity bill.	• LT and HT tariffs as per MERC or MSDCL in view of applicability, rates of contract demand, energy charges, and fuel cost adjustment, penalties & incentives to consumers. • Selection of proper tariff for particular application. • Impact of tariff on energy management, ROI with depreciation, straight line depreciation, sinking fund depreciation, reducing balance depreciation. (Numerical).
	UNIT-5 HRS Energy Audit –Hrs 10 , Marks-16	
5.1	Know the concept, procedure of energy audit & roll of energy auditor.	• Need of Energy Audit • Principles of energy Audit. • Preliminary audit & detailed audit. • Procedure of carrying out energy audit. • Energy flow diagram or sankey diagram. • Measurements & calculations in energy audit. • Calculation of payback period for energy conservation. Factors to be considered while preparing energy audit report. 1. Prepare simple energy audit report. 2. Roll and responsibilities of energy auditor.
5.2	List out energy conservation equipments and select proper energy conservation equipments in various applications.	• Study of energy conservation Devices such as 1. Occupancy sensors / Motion Detectors. 2. Control gears: Dimmers, Regulators, and Stabilizers. 3. Power Factor Controller and Intelligent p.f. controller (IPFC) 4. Maximum demand controller. 5. KVAR controller. 6. Energy Monitor 7. Dusk to dawn monitor. 8. Welding equipment monitor.
	UNIT-06 Energy Management HRS -05,Marks-08	

6.1	State the methods of energy Management, DSM & its objectives. Know the measures of DSM, its advantages, program planning & roll & responsibility of energy manager.	• Methods of energy Management. 1. Concept of supply side management. 2. Demand side management. 3. Objectives of DSM, types of DSM. 4. Measures for DSM. 5. Advantages of DSM and obstacles to implement DSM program. 6. DSM program planning / steps. 7. Roll and responsibilities of energy manager.
	Unit 07 Energy and the Environment Hrs-03,Marks-06	
7.1	Find out the effect of energy on environment.	• Energy & the environment. • Environment and social concerns related to energy utilization. • The Greenhouse Effect.
7.2	Co-relate the energy and environment Management	• Global warming:– effect of global warming and climate change, Pollution, Acid Rains, global energy and environment Management.
7.3	Suggest the Future Alternative for energy management.	• Future Alternative: World energy in 21st century, the all-electrical economy, the hydrogen economy.

List of practical's / Assignments:

Sr. No.	Tutorial/Exercise	Approx. Hrs. Required
01	Search on website of power ministry or MERC for electricity act 2001 & its amendments. Write a report on features of act, function of Government organizations like MNRE, MPC, BEE and Non-Government Organizations.	04
02	To determine the energy saving by using electronic ballast & regulator as compare to electromagnetic choke & resistive regulator	02
03	Measure the illumination of existing lighting system of lab / workshop/ library. Redesign the same for standard illumination level with energy efficient lamps / LEDs. Record the energy saving, calculate payback period & cost saving.	04
04	Design street lighting system with sodium / mercury vapour lamps and energy efficient lamps and determine the energy saving, payback period & cost saving.	02
05	Measurement of energy in induction motor at particular load without p.f. improvement device and with latest p.f. improvement device. Compare the energy consumption in both cases, calculate payback period & cost saving.	04
06	Measurement of energy in induction motor with conventional starter and soft starter. Compare the energy consumption in both cases, calculate payback period & cost saving.	04
07	Analysis of mechanical load on 3 phase induction motor & decide whether it should be connected in star or delta, so that motor should operate at maximum efficiency. (Hint: Perform load test on I.M. & draw efficiency curve from no load to full load. Also determine efficiency of I.M. in star & delta for same load, show on efficiency curve & write your conclusion.)	04
08	Market survey on I.M. : Collect the catalogue of induction motor and energy efficient induction motor of different manufactures and prepare report comprises • Comparison on technical aspects. • Cost / benefit analysis. • Justification for use energy efficient motors.	04

09	Search on website the various opportunities of energy saving in furnace /oven / pumping system /compressor.	02
10	Search on website the various opportunities of energy saving in refrigeration / air conditioning.	02
11	Analysis of electricity bill of any industry / commercial complex / public water works / irrigation scheme / educational institute / sewage treatment plant and prepare a report comprises following points. • Applicability as per tariff. • Demand charges & energy charges. • Contract demand & sanction load. • Fuel adjustment cost. • Electricity duty. • P.F. calculation, incentive & penalty. • Prompt payment discount. • Delayed payment charges. • Rate of interest on arrears. • Load factor incentive. • Penalty for exceeding contract demand. • Additional contract demand charges for consumers having captive power plant. • EHV supply rebate. • Security deposit.	04
12	Study of any one energy audit report of electric motors/ lighting system / HVAC systems from web site in indian scenario and prepare report comprises • Benefits of energy audit. • Cost / benefit analysis.	02
13	Perform energy audit & prepare energy audit report for a small industry / workshop / street light / main building of institute / hostel.	04
14	Visit to receiving substation / small industry and prepare DSM program and list out the possible obstacles to implement program.	02
	Total	32

Note:
- Perform any ten practicals / assignments.
- Use internet facility twice month.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION-1	
1	Motives of Energy Conservation And Management	Lecture, discussion and internet
2	Energy Conservation Techniques in Electrical System	Lecture, discussion and internet
3	Energy Conservation in Electrical & Thermal Utility Systems	Lecture, discussion and internet
	SECTION-2	
4	Economics of Energy Conservation	Lecture, discussion and internet
5	Energy Audit	Case study , Project Work and internet
6	Energy Management	Lecture, discussion and internet
7	Energy and the Environment	Lecture, discussion and internet

Text Books:

Sr. No.	Title	Author	Publication
1	Energy Management	Paul O' Callagham	Tata McGraw hill, Delhi
2	Energy Management Handbook	W. C. Turner	Wiley Press
3	Efficient Use And Management Of Electricity In Industry	B. G. Desai J. S. Rana A. V. Dinesh R. Paraman	Devki Energy Consultancy PVT. Ltd
4	Efficient Electricity Use hand book	Craig B. Smith	Pergaman Press

Reference Books:

Sr. No.	Title	Author	Publication
1	Renewable energy sources and conservation	N. G. Bansal Kleemon & Meliss	TMH Publication
2	Solar Energy	S.P. Sukhatme	Tata McGraw hill, Delhi
3	Art of reading electricity bill (HT) with Reactive power & Power quality management	Yogendra Vasant Talware Prakash Bedekar	Dnyatavya Prakashan,Pune
4	Art of reading electricity bill (LT)	Yogendra Vasant Talware	Dnyatavya Prakashan,Pune

Learning Recourses:

1) International journal of recent technology & engineering papers published time to time on energy conservation & management.
2) Visit to http://www.bee-india.nic.in, Reference books, Report of case studies, Magazines related to energy management & audit.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION-1				
1	Motives of Energy Conservation And Management	04	00	00	04
2	Energy Conservation Techniques in Electrical System	06	06	06	18
3	Energy Conservation in Electrical & Thermal Utility Systems	06	06	06	18
Total (section-1)		**16**	**12**	**12**	**40**
	SECTION-2				
4	Economics of Energy Conservation	02	04	04	10
5	Energy Audit	04	06	06	16
6	Energy Management	02	04	02	08
7	Energy and the Environment	02	02	02	06
Total (section-2)		**10**	**16**	**14**	**40**

(Prof.J.D.Naik,Prof.K.M.Kakade)
Prepared By

(Prof.S.V.Chaudhari)
Secretary, PBOS

(Prof.M.A.Chigteri)
Chairman, PBOS

Programme	:	CE/EE/ET/ME//MT/CM/IT/DDGM
Programme Code	:	01/02/03/04/05/06/07/08/21//22/23/24/26
Name of Course	:	Development of Soft Skills - I
Course Code	:	NC 481

Teaching Scheme:

	Hours /Week	Total Hours
Theory	--	--
Practical	02	32

* NON EXAM.NON CREDIT COURSES (COMPULSORY) # Credits over & above 180 credits

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	--	--
Marks	--	--	--	--	25

Course Rationale:

This course aims to make students aware of good interpersonal relations, Professionalism in etiquettes, importance of time management and importance of good health. The techniques such as role play, group discussions can be used effectively to demonstrate understanding emotions of persons in daily contact.

Course Objectives:

After studying this course, the student will be able to

- Develop better interpersonal relations among their peer group, subordinates and superiors and work effectively.
- Display corporate etiquettes and professionalism while attending /answering phone calls. Plan time optimally/effectively in office –work as well for their personal growth.
- Understand strengths and weaknesses of self.
- Understand /feel emotions of persons (from office and family) in daily contact and take appropriate actions.
- Demonstrate habits for keeping good health by following good food habits and daily exercise.
- Develop overall personality and be successful in his/her career.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weigh tage
1.	**Interpersonal Skills through Personal Development**			
	1.1	Reducing conflict by preventing problems in the classroom.	--	--
	1.2	Interpersonal Skills through Self Development and change.		
2.	**Corporate Etiquettes & Professionalism**			
	2.1	Understanding Self	--	--
	2.2	Polished personal habits		
	2.3	Ethics & Etiquettes: a way of life		
	2.4	Personal Attire & Grooming		
	2.5	Cell phone manners		

3.	**Time Management**			
	3.1	Time management skills in groups for completion of project	--	--
	3.2	Factors that lead to time loss and how they can be avoided		
	3.3	Time matrix & urgent versus , Important jobs		
4.	**Managing Emotions**			
	4.1	To understand and identify emotions;	--	--
	4.2	To know our preferences		
	4.3	Strength, weaknesses ,opportunities and threats , Techniques of self control		
	4.4	To get desirable response from others		
5.	**Health Management**			
	5.1	Importance of health management,	--	--
	5.2	Relevance of it ,		
	5.3	Tips to maintain good health		
		Total	--	--

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Case studies to be discussed in a group and presentation of the same by group /group leader.	04
2.	Field exercises for the group of students.	02
3.	Role play by individual/group leader.	04
4.	Arranging Quizzes, puzzle- solving and educational games.	02
5.	Group discussions.	04
6.	Sharing of self -experiences in a group.	04
7.	Brain storming sessions	02
8.	Questionnaire -filling & discussing results of the same in a group.	04
9.	Live demonstrations on Yoga and other stress relieving techniques by professional persons.	06
	Total	32

Reference Books:

Sr. No	Author	Title	Publication
1.	Mr. Shiv Khera	You can win	
2.	Mr Abdul Kalam	Wings of Fire	
3.	Mr Nirfarake	Prabhavi Vyaktimatwa.(Marathi)	
4.	Mr Iyyengar	YogaDipika	
5.	Mr. Anand Nadkarni	Tan tanavache niyojan (Marathi)	
6.	Mr. Rajiv Sharangpani	Khusit raha ,Mast Jaga.(Marathi)	

Learning Resources : Video cassettes on 1. Effective Communication 2. Group discussions, 3.Corporate Etiquettes and professionalism.

Prepared By

(D.K.Bhandare)
Lect. in Civil Engineering

(S. V.Chaudhari)
Member Secretary, PBOS

(M.S.Satarkar)
Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Programme	:	Diploma in CE/EE/ET/ME/ MT/CM/IT/DDGM
Programme Code	:	01/02/03/04/05/06/07/8/21/22/23/24/26
Name of Course	:	Development of Soft Skills – II
Course Code	:	NC 482

Teaching Scheme:

	Hours /Week	Total Hours
Theory	--	--
Practical	02	32

* NON EXAM.NON CREDIT COURSES (COMPULSORY) - B # Credits over & above 180 credits

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	--	--
Marks	--	--	--	--	25

Course Rationale:

This course aims to make students aware of importance of goal setting , develop self study techniques , importance of ethics and value system , This also aims one to inculcate creative mind along with interest in using problem solving techniques while dealing with any work. It also emphasizes about importance of stress relieving techniques to be practiced for good health.

Course Objectives:

After studying this course, the student will be able to

- Understand importance of goal setting and strategies for setting one's goal.
- Develop and practice self- study techniques.
- Use and practice stress management techniques for good health
- Use and practice problem solving skills.
- Understand importance of ethics and value system for positive interpersonal relations.
- Develop overall personality and be successful in his/her career.

Course Content:

Sr. No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**Motivation & Goal Setting**			
	1.1	Importance of goal setting,	--	--
	1.2	How to set SMART goals.		
2.	**Study Habits**			
	2.1	Note taking, Methods of Learning,	--	--
	2.2	Memory Enhancement, self - Study Techniques,		
	2.3	Techniques for effective Reading and Writing.		
3.	**Stress Management**			
	3.1	Stresses in groups, how to control emotions,	--	--
	3.2	Strategies to overcome stress, understanding importance of good health to avoid stress.		

4.	**Ethics & Motivation**			
	4.1	What are ethics, how ethics help to ensure positive interpersonal relations,	--	--
	4.2	Personal value system, and personal quality primer		
5.	**Creativity**			
	5.1	Definition of Creativity, Tips and ways to increase creativity, importance of creativity.	--	--
6.	**Problem Solving Techniques**			
	6.1	Puzzles and technical quizzes to be organized to develop these skills.	--	--
	Total		--	--

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Case studies to be discussed in a group and presentation of the same by group /group leader.	04
2.	Field exercises for the group of students.	02
3.	Role play by individual/group leader.	04
4.	Arranging Quizzes, puzzle- solving and educational games.	02
5.	Group discussions.	04
6.	Sharing of self -experiences in a group.	04
7.	Brain storming sessions	02
8.	Questionnaire -filling & discussing results of the same in a group.	04
9.	Live demonstrations on Yoga and other stress relieving techniques.	06
	Total	**32**

Reference Books:

Sr. No	Author	Title	Publication
1.	Mr. Shiv Khera	You can win	
2.	Mr Abdul Kalam	Wings of Fire	
3.	Mr Nirfarake	Prabhavi Vyaktimatwa.(Marathi)	
4.	Mr Iyyengar	YogaDipika	
5.	Mr. Anand Nadkarni	Tan tanavache niyojan (Marathi)	
6.	Mr. Rajiv Sharangpani	Khusit raha ,Mast Jaga.(Marathi)	

Learning Resources: Video cassettes on 1. Motivation & Goal Setting
2. Stress Management,3. Ethics & Motivation

Prepared By

(D.K.Bhandare)	(S. V.Chaudhari)	(M.S.Satarkar)
Lect. in Civil Engineering	Member Secretary, PBOS	Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

TextBooks:

Sr. No	Author	Title	Publication
1.	A.K. Sawhney	Electrical Machine Design	Dhanpat Rai & Co. (P) Ltd.
2.			

ReferenceBooks:

Sr. No	Author	Title	Publication
1.	M.G.say	A.C.Machines	
2.			

LearningResources: Books,Models,ChartsandDrawings.

SpecificationTable:

Sr. No.	Topic	CognitiveLevels			Total
		Knowledge	Comprehension	Application	
1	Introduction to Design of three phase transformer	-	-	04	04
2	Design of Three phase Transformers	04	06	06	16
3	Cooling of transformers	03	03	06	12
4	Design of single phase shell Type Transformers	04	04	06	14
5	Introduction to design of Induction Motors	06	06	16	28
6	Introduction to design of single phase Induction Motors	02	02	02	06
7	Design of Magnet coils	19	21	40	80

Mrs.M.H.Bilgi
(Prepared By)

S.V.CHAUDHARI
(Secretory,PBOS)

Mrs.M.A.Chigteri
(Chairman,PBOS)

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

LEVEL-V

Course Code	Course Title	Teaching Scheme				Examination Scheme					
		L	P	T	C	PA	TH	TW	OR	PR	TOTAL
EE581	Industrial Automation	3	2	1	6	20	80	--	--	50	150
EE583	Electrical Machine Design	3	2	1	6	20	80	--	50	--	150
EE584	Micrcontroller and Applications	3	2	1	6	20	80	--	--	50	150
EE585	Illumination Engineering	3	2	1	6	20	80	--	50	--	150
EE586	Electrical Building Maintenance System	3	2	1	6	20	80	--	50	--	150
EE587	Modern Electric Traction	3	2	1	6	20	80	--	50	--	150

Programme : Diploma in EE
Programme Code : 02 / 22 / 16
Name of Course : Industrial Automation
Course Code : EE581

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	--	6	20	80	--	--	50	150	YES

Course Rationale:
The aim of this course is to develop the technician to carry out the responsibility in the industry related to industrial control and automation. Diploma holder employed in the industry needs to operate test and maintain the industrial control circuits. It is very essential for him to know the PLC programming and logic of process control circuits.

Course Objectives:
After studying this course, the student will be able to
- Understand the different types of control circuits.
- Design and read the electromechanical circuits.
- Develop ladder diagram for various logics.
- Study and interpret process controls and convert it to logical sequence and draw ladder for the same.
- Understand analog signal processing.
- Carry out installation, troubleshooting and maintenance of PLCs.
- Understand general concepts of SCADA system.

Course Content:

SECTION I			
UNIT-I Introduction to Control Circuits HRS-03 MARKS-04			
Major learning outcome		Topic and subtopics	
1.1	Explain general idea of controls.	1.1	General idea of controls.
1.2	State the advantages of magnetic control over manual control.	1.2	Manual controls, Magnetic controls, Relay Logic. Disadvantages of manual control.
1.3	Explain Semi-automatic and Automatic controls.	1.3	Semi-automatic and Automatic control of modern machinery
1.4	Develop control circuits for DOL Starter.	1.4	Concept of Power circuit and Control circuit. Development of two-wire and three-wire control circuits. Control of Induction motor by DOL Starter. Remote control operation of motor.
1.5	Develop control circuit with interlocking.	1.5	Concept of interlocking of drives, necessity and development of control circuit.
UNIT-II Control Circuit Components HRS-06 MARKS-08			
2.1	List types of switches.	2.1	Input devices – Push button switches, Foot switches, Selector switches, Drum switches. Their working, uses and ratings. Concept of NO, NC, Latch and Unlatch.
2.2	Explain working of Limit switch.	2.2	Simple Limit switch. Its working, uses and ratings.
2.3	Explain working of Proximity switches.	2.3	Proximity switches. Inductive, Capacitive, Photoelectric, Ultrasonic. Their working, uses and ratings.
2.4	Explain working of Pressure switches, Float switches, Reed Relay.	2.4	Pressure switches, Float switches, Reed Relay. Their working, uses and ratings.
2.5	Explain working of slotted disks, encoders.	2.5	Angle position sensors – slotted disks, encoders. Their working, uses and ratings.
2.6	Explain construction and working of Solenoid type Contactors.	2.6	Output devices – Solenoid type Contactors. Their construction, working applications and ratings.
2.7	Explain use of Relays as output devices of PLC.	2.7	Relays as output devices of PLC.

2.8	Tell use of Timers in control circuits.	2.8	Use of Timers in control circuits.
2.9	Tell use of Pilot lamps, Indicating lights, Annunciator Panel.	2.9	Use of Pilot lamps, Indicating lights, Annuciators.
2.10	Draw symbols of devices.	2.10	Symbols of above devices.
	UNIT-III Designing of Control Circuits HRS-03 MARKS-04		
3.1	Design Power and Control circuit for Star-Delta Starter – Manual, Semi-automatic, Automatic.	3.1	Star-Delta Starter – Manual, Semi-automatic, Automatic.
3.2	Design Power and Control Circuit for Forward – Reverse control of 3 phase induction motor.	3.2	Forward – Reverse control of 3 phase induction motor.
3.3	Design Power and Control Circuit for Forward – Reverse control of 1 phase induction motors - Universal motor, Permanent Split capacitor motor.	3.3	Forward – Reverse control of 1 phase induction motors - Universal motor, Permanent Split capacitor motor.
	UNIT-IV Fundamentals of Programmable Logic Controllers HRS-08 MARKS-10		
4.1	Define PLC.	4.1	PLC Definition.
4.2	List PLC manufacturers.	4.2	PLC manufacturers
4.3	Compare PLC with Relay Logic.	4.3	Advantages and disadvantages of PLC over relay logic.
4.4	Compare PLC with PC.	4.4	Advantages and disadvantages of PLC over PC.
4.5	List types of PLCs.	4.5	Type of PLCs.
4.6	Describe architecture of PLC.	4.6	Architecture of PLC. – block diagram, Input image file, output image file, scan cycle and watchdog timer.
4.7	Explain sink/source concept.	4.7	Input output modules – Types, sink/source concept.
4.8	Show connections of I/O devices to PLC.	4.8	Connection of I/O devices to PLC.
4.9	Explain power supply for PLC systems.	4.9	Function of Power supply in PLC – Load Power supply, PLC Power supply. Technical specifications of power supply.
4.10	Compare communication protocol cables for PLC.	4.10	Communication protocols – RS 232, RS485, Ethernet. Features, limitations, cables and terminations.
	UNIT-V PLC Ladder Diagram Programming HRS-12 MARKS-14		
5.1	List Programming languages of PLC.	5.1	Programming languages of PLC. IEC 61131-3.
5.2	Explain rules for ladder programming.	5.2	Rules for proper construction of PLC Ladder Diagram.
5.3	Draw and explain simple ladder diagrams.	5.3	Programming On-Off inputs to produce On-Off outputs. NO, NC, Latch, Unlatch, Memory. Addressing systems.
5.4	Draw and explain ladder diagrams for logic gates.	5.4	Programming Logic gates.
5.5	Draw and explain ladder diagrams using Timers.	5.5	PLC Timer function block, Types of timers.
5.6	Draw and explain ladder diagrams using Counters.	5.6	PLC Counter function block, Types of Counters.
5.7	Draw and explain ladder diagrams for Arithmetic functions.	5.7	PLC Arithmetic functions - Addition, Subtraction, Multiplication, Division.
5.8	Draw and explain ladder diagrams for Comparison Functions.	5.8	PLC Number comparison functions - Equal to, Not equal, Greater than, Greater than equal to, Less than, Less than equal to.
	SECTION II		
	To draw UNIT-VI Ladder Diagram for Process Control HRS-14 MARKS-16		
6.1	Flowchart a process. Create basic ladder diagram from sequence of operational steps. Describe these steps.	6.1	Creating ladder diagram from process control description. Flow charting and development of ladder diagram.
6.2	Develop ladder diagram for Sequential operation of	6.2	Sequential operation of motors.

	motors.		
6.3	Develop ladder diagram for Planner machine.	6.3	Planner machine.
6.4	Develop ladder diagram for Skip Hoist control.	6.4	Skip Hoist control.
6.5	Develop ladder diagram for Automatic control of water pump.	6.5	Automatic control of water pump.
6.6	Develop ladder diagram for Air Compressor.	6.6	Air Compressor.
6.7	Develop ladder diagram for Conveyor system.	6.7	Conveyor system.
6.8	Develop ladder diagram for Pneumatic / Hydraulic System.	6.8	Pneumatic / Hydraulic System.
	UNIT-VII PLC Analog Operations HRS-04 MARKS-06		
7.1	Differentiate between discrete and analog operation of PLC.	7.1	Discrete and analog signals.
7.2	List and define the various major types of PLC analog inputs and outputs with their ranges.	7.2	Types of Analog modules and systems and their rages. Analog signal processing.
7.3	Develop ladder diagram for analog application.	7.3	PLC Analog output applications.
	UNIT-VIII PLC Installation, Troubleshooting and Maintenance HRS-10 MARKS-12		
8.1	Describe operating environment for PLC.	8.1	Consideration of the operating environment.
8.2	List and discuss the procedure for checking the parts of PLC as received from the manufacturer.	8.2	Receiving and checking of PLC.
8.3	Describe the procedure for assembling and interconnecting the PLC system.	8.3	Testing and assembly. Electrical connections.
8.4	List the reasons for grounding and suppression and how they both are accomplished.	8.4	Grounding and suppression. Circuit protection and wiring.
8.5	List and describe PLC troubleshooting procedures.	8.5	Troubleshooting PLC malfunctions.
8.6	List and describe general and preventive maintenance procedure for PLCs.	8.6	PLC maintenance.
8.7	List factors to be considered for selection of PLC.	8.7	Factors to be considered in selecting PLC.
	UNIT- IX Introduction to SCADA HRS-04 MARKS-06		
9.1	Define SCADA.	9.1	Definition of SCADA.
9.2	Explain architecture of SCADA.	9.2	Architecture of SCADA.
9.3	Explain the terms MTU and RTU.	9.3	Master terminal unit and Remote terminal unit.
9.4	Explain Real time SCADA.	9.4	Real time SCADA.
9.5	State advantages and limitations of SCADA.	9.5	Advantages and limitations of SCADA.

Specification Table:

Sr. No.	Topic	Cognitive Levels			
		Knowledge	Comprehension	Application	Total
1	Introduction to Control Circuits	02	--	02	04
2	Control Circuit Components	04	04	--	08
3	Designing of Control Circuits	--	--	04	04
4	Fundamentals of Programmable Logic Controllers	04	06	--	10
5	PLC Ladder Diagram Programming	04	--	10	14
6	Ladder Diagram for Process Control	04	--	12	16
7	PLC Analog Operations	02	02	02	06
8	Installation, Troubleshooting and Maintenance	08	04	--	12
9	Introduction to SCADA	04	02	--	06

List of Practical/Experiments/Assignments:

Sr. No.	Unit	Name of Practical/Experiment/Assignment	Hrs
1.	I	To develop control circuit for DOL starter.	02
2.	II	To draw symbols of power and control circuit components.	04
3.	III	To develop control circuit for Star-Delta starter.	02
4.	III	To develop control circuit for Forward-Reverse control of motor.	02
5.	V	To develop ladder diagram for DOL starter.	02
6.	V	To develop ladder diagram for all logic gates.	02
7.	V	To develop ladder diagrams using Timers and counters.	02
8.	V	To develop ladder diagrams using Arithmetic functions and comparison functions.	02
9.	VI	To develop ladder program for Planner machine.	02
10.	VI	To develop ladder program for Skip Hoist control.	02
11.	VI	To develop ladder program for Automatic control of water pump.	02
12.	VI	To develop ladder program for Air Compressor.	02
13.	VI	To develop ladder program for Conveyor system.	02
14	VI	To develop ladder for A+ B+ A- B- pneumatic / hydraulic system.	02
15	VII	To develop ladder program for Analog system.	02
		Total	32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction to Control Circuits	Lecture.
2	Control Circuit Components	Lecture, Audio/Visual Aids, WEB resources.
3	Designing of Control Circuits	Lecture, Q/A & Problem solving.
4	Fundamentals of Programmable Logic Controllers	Lecture, Audio/Visual Aids.
5	PLC Ladder Diagram Programming	Lecture, Audio/ Visual Aids, Q/A & Problem solving.
6	Ladder Diagram for Process Control	Lecture, Audio/ Visual Aids, Q/A & Problem solving.
7	PLC Analog Operations	Lecture, Audio/ Visual Aids, Q/A & Problem solving.

8	Installation, Troubleshooting and Maintenance	Lecture, Audio/Visual Aids.
9	Introduction to SCADA	Lecture, Audio/Visual Aids.

Text Books:

Sr. No.	Author	Title	Publication
1	S. K. Bhattacharya and Brijinder Singh	Control of Machines	New Age International Publication
2	John W. Webb and Ronald A. Reis	Programmable Logic Controllers	Prentice-Hall of India Private Limited

Reference Books:

Sr. No.	Author	Title	Publication
1	U. S. Eswar	Handbook of Electrical Motor Control Systems	Tata McGraw-Hill Publishing Company Limited
2		User Manuals from PLC Manufacturers	

Learning Resources: Books, Audio/Visual Aids, PLC manufacturer's websites, Programming Software.

(Prof. C. Y. Totewar)
Prepared By

(Prof. S. V.Chaudhari)
Secretary, PBOS

(Mrs. M. A.Chigteri)
Chairman, PBOS

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

2.4	Explain working of Pressure switches, Float switches, Reed Relay.	2.4	Pressure switches, Float switches, Reed Relay. Their working, uses and ratings.
2.5	Explain working of slotted disks, encoders.	2.5	Angle position sensors – slotted disks, encoders. Their working, uses and ratings.
2.6	Explain construction and working of Solenoid type Contactors.	2.6	Output devices – Solenoid type Contactors. Their construction, working applications and ratings.
2.7	Explain use of Relays as output devices of PLC.	2.7	Relays as output devices of PLC.
2.8	Tell use of Timers in control circuits.	2.8	Use of Timers in control circuits.
2.9	Tell use of Pilot lamps, Indicating lights, Annunciator Panel.	2.9	Use of Pilot lamps, Indicating lights, Annuciators.
2.10	Draw symbols of devices.	2.10	Symbols of above devices.
	UNIT-III Designing of Control Circuits HRS-03 MARKS-04		
3.1	Design Power and Control circuit for Star-Delta Starter – Manual, Semi-automatic, Automatic.	3.1	Star-Delta Starter – Manual, Semi-automatic, Automatic.
3.2	Design Power and Control Circuit for Forward – Reverse control of 3 phase induction motor.	3.2	Forward – Reverse control of 3 phase induction motor.
3.3	Design Power and Control Circuit for Forward – Reverse control of 1 phase induction motors - Universal motor, Permanent Split capacitor motor.	3.3	Forward – Reverse control of 1 phase induction motors - Universal motor, Permanent Split capacitor motor.
	UNIT-IV Fundamentals of Programmable Logic Controllers HRS-08 MARKS-10		
4.1	Define PLC.	4.1	PLC Definition.
4.2	List PLC manufacturers.	4.2	PLC manufacturers
4.3	Compare PLC with Relay Logic.	4.3	Advantages and disadvantages of PLC over relay logic.
4.4	Compare PLC with PC.	4.4	Advantages and disadvantages of PLC over PC.
4.5	List types of PLCs.	4.5	Type of PLCs.
4.6	Describe architecture of PLC.	4.6	Architecture of PLC. – block diagram, Input image file, output image file, scan cycle and watchdog timer.
4.7	Explain sink/source concept.	4.7	Input output modules – Types, sink/source concept.
4.8	Show connections of I/O devices to PLC.	4.8	Connection of I/O devices to PLC.
4.9	Explain power supply for PLC systems.	4.9	Function of Power supply in PLC – Load Power supply, PLC Power supply. Technical specifications of power supply.
4.10	Compare communication protocol cables for PLC.	4.10	Communication protocols – RS 232, RS485, Ethernet. Features, limitations, cables and terminations.

Programme Code : 02 / 16 / 22

Name of Course : Electrical Machine Design

Course Code : EE 583

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	-	6	20	80	-	50	-	150	YES

Course Rationale:
Most of the Diploma holders working in various industries, state electricity boards, contracting firms etc. must know the basics of machine design. This is a core technology course which intends to teach the student design aspects of electrical machines like transformers, single phase and three phase induction motors.

Course Content:

	Major Learning Outcomes	Topic and subtopics
	SECTION-1	
	Unit -1 Introduction to Design of three phase transformer Hrs 06 Marks 10	
1.1	State the working principle of transformer and explain the function of different parts of the transformer.	Review of construction and working of three phase transformer.
1.2	State the different types of core constructions and their advantages.	1. Core construction. • Core Construction-types • Advantage of using stepped core over rectangular core • Limb section • Yoke construction
1.3	State the types of windings and factors governing choice of winding.	2. Transformer windings • Factors governing choice of winding • Types of windings.
	Unit-2 Design of Three phase Transformers Hrs 12 Marks 14	
2.1	Write the step by step procedure to design three phase transformer. Calculate dimensions of core, yoke and winding details for given rating and type of three phase transformer.	1. Output equation of 3 phase transformer. 2. Design of transformer- • Core design. • Window dimensions • Yoke design • Overall dimensions of frame • L.V. winding & H.V. winding
	Unit-3 Cooling of transformers Hrs 08 Marks 08	
3.1	Describe the necessity of cooling system for transformer.	1. Cooling systems.

	State and explain different types of cooling systems of transformers.	Transformer oil as a cooling medium. Temperature rise in plane walled tanks.
3.2	Step by step procure to design tank with cooling tubes. Calculate number of cooling tubes for transformer tank	2. Transformer tank and calculation of number of cooling tubes. 3. Design of tank with tubes. 4. Numerical on Tank design.
Unit-4 Design of small single phase shell Type Transformers Hrs 06 Marks 08		
4.1	State the step by step procedure to design a single phase shell type transformer. Calculate overall dimensions and winding details of small single phase shell type transformer.	1. Introduction 2. Core design 3. Winding design 4. Windows area 5. Numerical on single phase shell type transformers.
SECTION-2		
Unit-5 Introduction to design of Induction Motors (3 phase, Squirrel Cage) Hrs 12 Marks 16		
5.1	State and explain the factors considered for designing three-phase induction motor.	1. Construction 2. Design consideration, specific loadings 3. Output equation 4. Choice of average flux density in the air gap 5. Choice of ampere conductors per meter 6. Efficiency and power factor 7. Main dimensions design (D & L) – Design Problem 8. Stator winding stator slots, rotor design etc.
Unit-6 Introduction to design of single phase Induction Motors Hrs 12 Marks 16		
6.1	State and elaborate the factors considered for designing single-phase induction motor.	1. Types of motors. 2. Starting characteristics 3. Construction 4. Output equation 5. Main dimensions 6. Relative size of single phase and three phase motors 7. Design of stator 8. Rotor design concept 9. Problems for the determination of main dimensions 10. Design of stator, rotor
Unit-7 Design of Magnet coils Hrs 08 Marks 08		
7.1	Know the step by step procedure to design Magnet coils	1. Types of magnets 2. Construction of magnets

		3. Design of magnet coil 4. current 5. Turns winding section 6. Temperature rise 7. Space factor 8. Design problem

List of Practical/Experiments/Assignments:

Sr. No	Name of practical/Experiment/Assignment
1	Design of three phase transformer 1. Calculations of dimensions. 2. Calculations of windings. 3. Calculations of core. 4. Calculations of cooling requirements. 5. Prepare design data sheet. 6. Prepare drawings as per design
2	Design of small single phase transformer 1) Calculations of dimensions 2) Calculations of windings 3) Calculations of core 4) Prepare design data sheet 5) Prepare drawings as per design
3	Design of three phase induction motors 1) Calculations of main dimensions .
4	Design of single phase induction motors 1) Calculations of main dimensions.
5	Report on Magnetic coil.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	**Introduction to Design of three phase transformer**	Lecture Method, Chalk & Board technique
2.	**Design of Three phase Transformers**	Lecture, Q/A technique
3.	**Cooling of transformers**	Lecture, Q/A technique
4.	**Design of single phase shell Type Transformers**	Lecture Method, Q/A technique
5.	**Introduction to design of Induction Motors**	Lecture Method, Q/A technique
6.	**Introduction to design of single phase Induction Motors**	Lecture Method, Q/A, technique
7.	**Design of Magnet coils**	Lecture Method, Q/A, technique

Text Books:

Sr. No	Author	Title	Publication
1.	A.K.Sawhney	Electrical Machine Design	Dhanpat Rai & Co.

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Reference Books:

Sr. No	Author	Title	Publication
1.	M.G.say	A.C.Machines	-

Learning Resources: Books, Models, Charts and Drawings.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	**Introduction to Design of three phase transformer**	02	04	04	10
2	**Design of Three phase Transformers**	02	06	06	14
3	**Cooling of transformers**	02	02	04	08
4	**Design of single phase shell Type Transformers**	02	02	04	08
5	**Introduction to design of Induction Motors**	04	06	06	16
6	**Introduction to design of single phase Induction Motors**	04	06	06	16
7	**Design of Magnet coils**	02	04	02	08

Mrs. M.H. Bilgi
(Prepared By)

S.V.CHAUDHARI
(Secretory,PBOS)

Mrs.M.A.Chigteri
(Chairman,PBOS)

Programme : **Diploma in EE**

Programme Code : **02 / 16 / 22**

Name of Course : **Microcontroller and Applications**

Course Code : **EE 584**

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	0	6	20	80	--	--	50	150	YES

Course Rationale:

This is an elective subject for diploma in Electrical Engineering. Now a days microcontrollers are extensively used in various applications ranging from simple domestic appliances to complex industrial environment control applications. Therefore there is a growing need of engineers / technicians in this field. Hence, it is necessary to study microcontroller basics, hardware and its programming.

This subject covers microcontroller 8051 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microcontroller based applications.

Course Content:

Section - 1		
Major Learning Outcomes		**Topic and subtopics**
Unit -1 Introduction to Microcontrollers		**Hrs 04 Marks 04**
1.1	Define the terms	Review of terms : CPU, Memory, Input unit, Output unit, BUS,RAM,ROM.
1.2	List the differences between microcontroller and microprocessor.	Comparison between a microcontroller and microprocessor.
1.3	Describe array of microcontrollers designed to handle data in Four-Bit to Thirty-Two-Bit	Four-Bit microcontrollers, Eight-Bit microcontrollers, Sixteen-Bit, microcontrollers, Thirty two- bit microcontrollers.
1.4	Draw the Schematic block diagram of a microcontroller and explain its features.	Schematic block diagram of a microcontroller. Features of microcontroller
1.5	Explain the difference between Von-neumann and Harward architecture	Von-neumann and Harward architecture.
1.6	Explain the difference between RISC and CISC machines	RISC and CISC machines.
1.7	Compare features of Commercial microcontroller	Features of Commercial microcontroller.
Unit-2 8051 Architecture		**Hrs 10 Marks 16**
2.1	Explain the Architecture of 8051 Microcontroller with its block diagram	Architecture □ Block diagram of internal architecture
2.2	Explain the pin diagram of 8051 Microcontroller	□ Pin diagram, function and alternate function of pins □ System clock, machine cycles and reset circuit.

2.3	Explain the memory organization of the 8051 Microcontroller	Memory Organization □ Internal program and data memory, external memory interface □ Register banks, bit and byte addressable area. □ Registers: PC, DPTR, A&B, PSW and other Special function , registers(SFR) □ Architecture of I/O ports
2.4	Define the stack and explain its uses	□ Stack and stack pointer register
2.5	Define the timers and counters and explain its uses	Timers and Counters. □ Timer/counter control logic and interrupts. □ TMOD and TCON SFR map. □ Timer modes of operation.
2.6	Define the Interrupts and explain its uses	Interrupts. □ Interrupt sources. □ IE and IP SFR map □ Interrupt priorities
2.7	Describe the additional features of the 8052 microcontroller	8052 microcontroller □ Comparison of 8051 and 8052 microcontroller
Unit-3 Basic Assembly Language Programming Concepts		**Hrs 06 Marks 06**
3.1	Explain use of Assembly language programming	Assembly language basics.
3.2	Describe the Assembly language programming process	Assembly language programming process.
3.3	Understand the 8051 assembly language syntax.	Programming of 8051, 8051 instruction syntax.
Unit-4 Instruction Set of 8051		**Hrs 12 Marks 14**
4.1	Explain the Instruction syntax and data types of the 8051	Instruction syntax and data types □ Opcode, Operand, label, comment, and assembler directives such as DB, ORG, EQU, END □ Data types and data range
4.2	Explain the Addressing modes of the 8051	Addressing modes □ Immediate, register, direct, indirect, indexed, relative, absolute, bit inherent, bit direct.
4.3	Explain the Instruction set of the 8051	Instruction set □ Definition of basic parameters: T-State, machine cycle, instruction cycle. □ Instructions: data transfer, arithmetic, logical, branching, subroutines, bit manipulation.
4.4	Explain the structure of an Assembly language program	Assembly language programming
4.5	Develop assembly language programs to perform simple operations	Develop assembly language programs for the following commonly used applications i) Addition, subtraction of two 8 bit, 16 bit signed/unsigned numbers. ii) Multiplication and division on two 8 bit/16 bit unsigned numbers. iii) Find largest and smallest number integer of an array. iv) Average of 8-bit numbers. v) Data transfer from one location to other. vi) Programmable delay generation. vii) Program to generate square wave on the port pin using timer. viii) Simple program for demonstrating interrupt service.

SECTION-2		
Major Learning Outcomes		**Topic and subtopics**
Unit-5 Arithmetic Operations		**Hrs 04 Marks 06**
5.1	Define flag	Flags
5.2	Use instructions to increment and decrement the contents of registers and RAM.	Incrementing and decrementing the contents of registers and RAM.
5.3	Do signed and unsigned addition and subtraction	Unsigned and signed addition and subtraction programs
5.4	Do Unsigned Multiplication and division.	Unsigned Multiplication and division programs
Unit-6 Jump and Call Instructions		**Hrs 04 Marks 06**
6.1	Use bit and byte conditional jump opcodes	Bit jumps, Byte jumps conditional jumps,
6.2	Use unconditional jump opcodes	unconditional jump
6.3	Write and call subroutines	Calls and Subroutines, Example Program
Unit-7 Peripheral interfacing with 8051 Microcontroller		**Hrs 12 Marks 14**
7.1	Write specification of Atmel 8051 micro-controller.	Introduction to Micro-controller, specification of Atmel 8051 micro-controller.
7.2	Interface simple push button relays ,latches and output data to LEDs.	Interfacing of basic component like LED's, Pushbuttons relay and Latches.
7.3	Input data from matrix keyboard and output to seven segment display.	Keyboard Interfacing: - Interfacing 7-segment LED Display and LCD display.
7.4	Interface 8 bit/12 bit ADC.	ADC interfacing
7.5	Use D/A converter to generate digital/analog waveforms.	DAC interfacing
7.6	Draw interfacing diagram and develop flowchart to interface stepper motor	interfacing stepper motor
7.7	Draw interfacing diagram and develop flowchart to interface DC motor	Interfacing DC motor.
Unit 8 Industrial Application of Micro-controller		**Hrs 12 Marks 14**
8.1	Draw interfacing diagram and develop flowchart for measurement application	**Measurement application :** Angular speed measurement, Temperature measurement, current, voltage ,power & Energy measurement
8.2	Draw interfacing diagram and develop flowchart for Automation and control applications	**Automation and control applications :** Digital PID Controller. DC Motor control Steeper Motor Control Temperature control

List of Practicals/Experiments/Assignments:

Sr. No	Name of practical/Experiment/Assignment
1	Study of 8051 Microcontroller.
2	Programming examples – Data transfer instructions.
3	Programming example s– Logical Operations.
4	Programming examples – Arithmetic Operations.
5	Programming examples – Jump and Call instructions
6	Demonstration and Testing of keyboard interface
7	Demonstration and Testing of LCD display
8	Demonstration and Testing of D/A or A/D converter Interface
9	Demonstration and Testing of Relay Interface
10	Demonstration and Testing of Measurement of speed
11	Demonstration and Testing of Measurement of temperature.
12	Demonstration and testing of Stepper motor control by 89C51 microcontroller.

Instructional Strategy:

Sr. No	Topic	Instructional Strategy
	Section-1	
1	**Introduction to Microcontrollers**	Lecture Method, AV aids
2	**8051 Architecture**	Lecture, AV aids
3	**Basic Assembly Language Programming concepts**	Lecture, Q/A , AV aids
4	**Instruction Set of 8051**	Lecture, Q/A, Problem Solving
	Section-2	
5.	**Arithmetic Operations**	Lecture, Q/A, Problem Solving
6.	**Jump and Call Instructions**	Lecture, Q/A, Problem Solving
7.	**Peripheral interfacing with 8051 Microcontroller**	Lecture, Q/A, Problem Solving , AV aids
8.	**Industrial Application of Micro-controller**	Lecture, Q/A, AV aids

Text Books:

Sr.No	Author	Title	Publication
1.	Kenneth Ayala	The 8051 Microcontroller	Cengage Learning
2.	V Udayashankara and M.S.Mallikarjunaswamy	8051 Microcontroller Hardware, software and Applications	McGraw-Hill Companies

Reference Books:

Sr. No	Author	Title	Publication
1.	Subrata Ghoshal	8051 microcontroller - internals, instructions, programming and interfacing	Pearson
2.	K. Uma Rao	The 8051 Microcontroller - Architecture, Programming and Applications	Pearson

Learning Recourses :

Teaching-Learning process in class-room, programming and its execution.

Specification Table :

Sr.No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
SECTION-1					
1	Introduction to Microcontrollers	04	--	--	4
2	8051 Architecture	08	08	--	16
3	Basic Assembly Language Programming Concepts	02	04	--	6
4	Instruction Set of 8051	04	02	08	14
	Total (Section-1)	18	14	08	40
SECTION-2					
4	Arithmetic Operations	02	--	04	6
5	Jump and Call Instructions	02	--	04	6
6	Peripheral interfacing with 8051 Microcontroller	02	04	08	14
7	Industrial Application of Micro-controller	04	06	04	14
	Total (Section-2)	10	10	20	40

(Prof. S.P. Phadnaik)
Prepared By

(S.V. Chaudhari)
Secretary, PBOS

(Prof. M.A. Chigteri)
Chairman, PBOS

Name of Programme : EE

Programme code : 02/16/22

Name of Course : Electrical Building Maintenance Systems
Course Code : EE 586

Teaching Scheme:

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	-	6	20	80	-	50	-	150	YES

Evaluation:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term Work
Duration	1 Hr	Three Hrs			---
Marks	20	80	---	50	--

Course Rationale:

This subject is classified under diversified technology group. It is intended to teach the students the various systems of modern buildings to achieve comfort conditions. The knowledge and skills gained will be help full while performing duties of electrical supervisor, maintenance engineer.

Course Outcomes of Building Management Systems (BMS)

- To manage & control the systems within a building to ensure a pleasant, controlled and safe environment.
- Install, service and maintain the systems like Heating, Ventilation and Air Conditioning , CCTV, Access Control, D.G. set, Elevator / escalator, Fire and Intruder Alarms, Lighting in multistoried buildings.

Course Contents:

Section I		
Unit-1 Modern electrical installation in Multistoried building Hrs: 08, Marks: 08		
1.1	Design electrical installation of big establishment according to I.E : Rules.	• I.E. Rules regarding electrical installation of multistoried building • Electrical installation of Multistoried building/mall, big hotels/ Hospitals, splitting load in accordance with standards.
1.2	Develop Troubleshooting chart and Maintenance schedule of electrical installation of multistoried building/ malls etc. Design modern illumination and its control of multistoried buildings.	• Troubleshooting and Maintenance of electrical installation of multistoried building. • Modern/automatic Illumination (lighting) system and control.
1.3	Design electrical installation for HVAC, fire protection, water lifting pump, hot water system and its control.	• Electrical installation for HVAC, fire protection , water lifting pump, hot water system.
UNIT-2 Elevators & escalator HRS -16, Marks-18		
2.1	State safety measures / precautions to be taken while working on elevator and in emergency condition on elevator and escalator.	**Occupational Safety and Health :** • Safety measures while working and emergency condition on elevator and escalator.

		• Review of general layout of elevator and escalator.
2.2	List the components of car operating panel and also state their function.	• Components of car operating panel and their function.
2.3	State the types and specification of cables/ wires used in control and power wiring circuit in lift/ escalator. List out the different types of sensors and limit switches used in elevator/escalator and also state their function.	**Control panel components** • Types of wires and cables used in lift and escalator. • Types of switches for control & power wiring • Types of sensors and limit switches used in elevators and escalators with their functions. • Concept of counter weight, buffer. • Difference between Geared and Gearless machine.
2.4	List the safety devices for elevator / escalator and state their function. State the necessity of electrical and mechanical interlock. Explain the breaking system used in lift /escalator.	**Protective systems in elevators and escalators:** • Elevator and escalator safety devices and their function . • Necessity of electrical/mechanical interlocks. • Braking Systems.
2.5	Why do we require maintenance of lift? Also state the methods of maintenance. State the types of lubricants with their properties used in lifts / escalator. State the importance of regular cleaning, dusting and lubrication. Write down the maintenance schedule for lift / escalator and state the check list for maintenance of lift/ escalator. Differentiate between the Preventive maintenance and brake-down maintenance of lift /escalator.	**Maintenance of elevator:** • Concept of lift /escalator maintenance. • Methods / Types of maintenance. • Types of lubricants used in lifts / escalator with their properties. • Importance of regular cleaning, dusting and lubrication. • Maintenance schedule and preparing check list. • Preventive maintenance and brake-down maintenance.
2.6	Diagnosis of faults in electrical power and control circuit of lift. Prepare trouble shooting chart based on logical sequence of testing of lift. State the importance of recording parameters and other service records of lift. Explanation of Auto rescue device (ARD)	**Troubleshooting of elevator:** • Troubleshooting elevator in terms of electrical power and control system. • Logical sequence of testing trouble in electrical power and control circuit. • Effects faulty and loose braking system. • Importance of recording parameters and other service records of lift. • Auto rescue device (ARD)
2.7	State the specification of elevator and different consideration for selection of elevators. State the statutory licenses for lift and escalator installation/ maintenance.	• Technical specification of elevator. • Different consideration for selection of elevators . • Statutory provisions for getting license.
	UNIT-3 Diesel Generator Set and Water lifting pump HRS – 08 Marks-14	
3.1	Draw a layout of D.G. set and state the function of main components of D.G. set.	**Diesel Generator Set :** • Review of general block diagram of D.G. set. • Diesel engine and its accessories, • The AC Generator, The control systems and switchgear, AMF controller and panel layout.
3.2	State the factors to be considered for selection and installation of D.G. set. Perform load assessment of any establishment and determine the capacity of D.G. set.	• Factors to be considered for Selection and Installation of D.G. set. • Load assessments and determination size of D.G. set. (numericals on to determine the size of D.G. set for

		particular application)
3.3	Explain operational testing of different systems (listed in theory content) of D.G. set. State the protections of D.G. set and explain with neat diagram. List out the safety measures and caution notices while working on D.G. set	• Operational testing of elements of D.G. set such as 1. Engine starting system; 2. Engine speed governing system; 3. Generator voltage regulating system; 4. Engine and generator cooling systems; 5. Engine air intake and exhaust system; 6. Engine lubricating oil system; and 7. Engine fuel system (liquid or gaseous fuel) 8. D.G. set noise reduction system. • Prime mover and generator protection. • Safety measure and caution notices while working on D.G. set.
3.4	State check list and maintenance schedule of D.G. set. Write-down trouble shooting chart of D.G. set.	• Installation, Maintenance and troubleshooting of D.G. set.
3.5	State the classification pump and explain with neat diagram the operation of centrifugal / submersible pump.	**Water lifting pump :** • Classification of pump, parts of centrifugal pumps and submersible pump.
3.6	State the factors to be considered for size and selection of pump. Determine the size of pump and its energy consumption for given conditions.	• Factors to be considered to determine the size of pump and selection of pump. • Power/ energy requirement for pumping and its control system.(Numericals based on size and power/ energy of pump)
3.7	Explain the installation procedure of water pump as per ratings of pump. Write down the maintenance schedule of water pump. Write-down trouble shooting chart of water pump.	• Installation, maintenance and troubleshooting of electrical water pump.
	Section II	
	UNIT-4 Heating ,Ventilation and Air Conditioning HRS -13, Marks-14	
4.1	• State the different types heating system, also state their features.	• Types of heating systems in building. Features of each system. • Ventilation and types of ventilation system.
4.2	Explain with block diagram vapour compression cycle.	• Review of AC terminology such as refrigerating effect, refrigerating capacity, work of compression, Coefficient of performance etc. • Basic components of Vapour compression cycle.
4.3	State the function, application & specifications of components of VCC.	• Function of compressor, types of compressor, specifications and application of compressor. • Function of condenser, types of condenser, specifications and application of condenser. • Function of expansion device, types, specifications and application of expansion devices. • Function of evaporator, types, specifications and application of evaporators. •
4.4	Classify the air conditioning system. Describe the layout of different types of air conditioning.	• Classification of air conditioning system. • Working of ductable split AC with line diagram. • Working of central AC with line diagram.

		• Working of window AC with line diagram.
4.5	Describe with a layout of different Refrigerators /water cooler/ ice plant. State different types of refrigerants.	• Types , electrical components of Refrigerator, Water cooler and Ice plant with line diagram. Types of refrigerants.
4.6	Explain with diagram different refrigeration and air conditioning controls.	**Refrigeration and air conditioning controls:** • HP and LP cutouts, solenoid valve, over load protector, Thermostat, humidity start, hermetical sealed compressor, antifreeze thermostat.
4.7	List the factors to be considered for air conditioning load calculation. Calculate the actual COP & power consumption of given refrigeration system Write down the check list for commissioning, maintenance and trouble shooting of refrigeration and air Conditioning.	• Factors to be considered for AC load calculation. • Calculation of and electrical power consumption as per refrigeration specification in ton. (Numericals) • Commissioning of Refrigeration and Air Conditioning. • Maintenance and troubleshooting of Refrigeration and Air Conditioning.
UNIT-5 Safety & security of building Hrs-15 Marks-18		
5.1	State the importance safety and security of building.	Need of safety and security of building.
5.2	State the classification of buildings based on occupancy for fire protection. State the classification of fire, Need of fire protection systems and different active and passive fire protection systems. What are the requirements for fire protection & safety for clearance from competent authority for buildings? Describe operation of fire blanket and fire bucket.	**Fire protection system:** • Classification of Buildings Based on Occupancy for fire protection. • Principals of fire prevention. • Classification of fire. • Fire protection & safety requirements • Different active and passive fire protection systems. • Review of Portable fire extinguishers. (covered in ITME hence only listing) • Fire blankets, fire buckets and hose and hose fitting.
5.3	Draw and describe the basic elements of a hydrant system. State the function of each element of hydrant system.	**Hydrant system:** • Layout of system from pump house to hydrant post. • Types hydrant system, function of elements of hydrant system.
5.4	Describe the operation and application on the following automatic fire sprinkler systems: 1. Wet-pipe system 2.dry-pipe system. 3. Pre-action system. 4. deluge system Differentiate between hydrant and sprinkler system. What are different types of non-water based fire suppression systems and describe how these systems extinguish fire.	**Sprinklers:** • Operation and use of automatic fire sprinkler systems (Wet-pipe system, dry-pipe system, pre-action system, deluge system) • Hydrant Vs sprinkler system. **Gaseous systems:** • Application, properties and operation of gaseous systems.
5.5	Describe the components of a fire alarm system and the different types of fire detectors.	**Fire detection and prevention system:** • Fire Detection and Alarm system.
5.6	Describe the maintenance schedule and troubleshooting chart of fire protection systems. State Does and Don'ts in emergency of fire.	• Maintenance and trouble shooting of above fire protection systems. • Does and Don'ts in emergency of fire.

5.7	Define intercom. State the different types of intercoms system. Draw general layout of intercom system and state the function of each components. Describe with block diagram the Party-Line Systems/ Matrix Systems/Wireless Systems, and their Accessories.	**Intercom system :** • Definition and different types of intercoms system. • General Layout of intercom system, components of intercom system and their functions. • The basic building blocks of various system such as Party-Line Systems, Matrix Systems, Wireless Systems, and their Accessories.
5.8	What is video conference system and how does it work? State the types of video conferencing system and compare them. Draw general layout video conferencing system and state the function of each component. Describe bridging architecture and state its functionality. Describe video call management and protocol conversion. What is device management and how does it work? What is security and content management?	**Video Conference system :** • Definition, Technological Issues. • Types of video conferencing system and their comparison. • Different components of a video conferencing system and their function. • The language of video conferencing, • Bridging architecture and functionality. • Video call management and protocol conversion, • Device management, Security, Content management.
5.9	State the Pro's &con's of surveillance system. Draw layout of CCTV systems and state the function of each equipments of system.	**CCTV system:** • Surveillance system • Pro's &con's of surveillance • Layout of CCTV systems, equipments of CCTV system, selection of equipments.
5.10	State the Function, specifications and application of Sequential Switcher /Matrix switcher/ Multiplexer / Digital video recorders (DVRs) .	Function, specifications and application of 1. Sequential Switcher. 2. Matrix switcher 3. Multiplexer 4. Digital video recorders (DVRs) .
5.11	List types of CCTV monitors and state its advantages. Differentiate between CCTV Monitor & Commercial Monitor.	CCTV Monitors & Its Advantages, Difference Between CCTV Monitor & Commercial Monitor.
5.12	State the different sensors used in CCTV system.	Sensors: Infrared sensors, Passive sensors, Motion detectors
5.13	State the effective implementation of remote controlled surveillance.	REMOTE -CONTROLLED SURVEILLANCE AND NETWORK CAMERAS 1. Remote-controlled surveillance 2. Network camera system 3. Video Signal and Control Signal Transmission
UNIT-6 Rules & regulations Hrs-04 Marks-08		
6.1	State the rules & regulations of building with respect to environment clearance to approve building plan.	• Rules & regulations of building with respect to environment clearance.
6.2	State the I.E. rules regarding buildings clearances from transmission and distribution of electrical power system / operation, construction and maintenance of elevators and Escalators.	• I.E. rules of buildings clearances from transmission and distribution of electrical power system. • I. E. rules pertaining to operation, construction and maintenance of elevators and escalators.
6.3	State the features of acts listed in theory content.	Features of following acts ➢ Apprentices act 1961, ➢ Minimum wages act 1948, ➢ Workmen's compensation Act 1923, ➢ Contract labour (Regulation and Abolition Act 1970),

		➢ Employer's liability Act 1938 and the industries disputes Act 1947. ➢ Maharashtra Lifts Act 1939 and lift rules 1958. ➢ Maharashtra Fire Prevention & Life Safety Measure Act, 2006 and measure rules 2009

List of Practicals:

Sr. No.	Unit No.	Practicals / Exercise	Hrs. Required
01		Study and interpretation of building drawings, also show electrical installation on it and list important structural and non structural members of building.	02
02	01	Develop electrical drawings (i.e. layout, single line diagram and wiring diagram) of Hotels/Hospitals/mall/ hostel/ multistoried building.	04
03	02	Visit to nearby lift installation site or working lift site. a) Demonstrate the working of elevator and components of elevator b) Preparation of check list for Do's and Don'ts for operation, maintenance and troubleshooting of elevator.	04
04	03	Assesses load requirement and determine the size of D.G. set for Hotels /Hospitals /malls /hostel/ multistoried building with detailed specifications.	04
05	03	Develop maintenance schedule and troubleshooting chart for D.G. set.	02
06	03	Determine water requirement and determine the size of electrical pump for Hotels /Hospitals /malls /hostel/ multistoried building with detailed specifications.	04
07	03	Develop maintenance schedule and troubleshooting chart for Water pump.	02
08	04	Identify the electrical and mechanical components of dissembled refrigerator in mechanical department laboratory. Tracing the electrical wiring diagram. Develop trouble shooting chart of refrigerator.	02
09	04	Visit to central AC plant. 1. Draw a layout. 2. Write down the function of each component. 3. Note down the factors which add to the heat load on the AC system.	04
10	05	Visit to nearby building to study fire fighting system or fire detection and alarm system. Draw its layout and list important components of system with function. List the precautionary measures to be taken to keep system up-to-date.	04

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Building Drawings	Lectures, discussion, PPTs
2	Modern electrical Installation in multistoried building	Lectures, discussion, PPTs and field visits
3	Elevator and escalator	Lectures, discussion, PPTs, videos and field visits
4	D.G. set and water lifting pump	Lectures, discussion, PPTs and field visits
5	Heating, Ventilation and air conditioning	Lectures, discussion, PPTs, videos and field visits
6	Safety and security of building	Lectures, discussion, PPTs, videos and field visits
7	Rules and regulations.	Lectures, discussion, PPTs

Text Books:

Sr. No.	Title	Author	Publication
1			
2	Wells and Pumps Engineering,	S D Khepar and A M Michael	
3	Pump: Theory & Practices,	Jain V K	
4	Fire Detection and Alarm system	M. M. Bhuskute	
5	Relevant teaching material from internet		

Sr. No.	Title	Author	Publication
1	Topic wise website collection	Internet	
2	Ground water Hydrology	H M Raghunath	
3	Fire protection engineering in building design	jane l. Lataille.	
4	Handbook of air conditioning and refrigeration	Shan K. Wang	McGraw hills

Learning Recourses:
Class room, PPT presentation, Text books & reference books, Industrial Visit.

Specification Table :

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Modern electrical Installation in multistoried building	00	02	06	08
2	Elevator and escalator	06	06	06	18
3	D.G. set and water lifting pump	02	04	08	14
4	Heating, Ventilation and air conditioning	04	06	04	14
5	Safety and security of building	08	04	06	18
6	Rules and regulations.	04	04	00	08
	Total	**24**	**26**	**30**	**80**

K.M. Kakade
(Prepared By)

A. S. Zanpure
(Secretory,PBOS)

Mrs.M.A.Chigteri
(Chairman,PBOS

Programme Code : 02 / 16 / 22

Name of Course : Modern Electric Traction

Course Code : EE 587

TEACHING SCHEME				EXAMINATION SCHEME						Class Declaration
L	P	T	C	PA	TH	TW	OR	PR	Total Marks	
4	2	-	6	20	80	-	50	-	150	YES

Course Rationale:

Electric traction means a locomotion in which the driving force is obtained from electric motors. One of the practical applications of electricity, which enters into the everyday life of many of us & its use in service of mass transport – the electric propulsions of vehicles – electric trains, trolley buses, tram cars and in the latest developments such as metro and sky bus.

Indian Railways (IR) is the largest organization that has very large job potential and opportunities for electrical engineering diploma holders; hence they should know the recent technological developments in this area of electric traction In view of the growing importance and technological developments, which have come about in this area in the recent past; for Electrical Engineering students, it is desirable to study the course dealing with electric traction. This subject belongs to technology area.

Course Content:

	Major Learning Outcomes	Topic and subtopics
	SECTION-1	
	Unit -1 .Overhead Equipments	**Hrs 04 Marks 06**
1.1	State the necessity of OHE and explain construction of simple and polygonal OHE.	Review of simple OHE and polygonal OHE
1.2	Understand the Principles of design of OHE. state the location and functions of Un-insulated and Insulated Overlaps, Neutral Section, Section Insulator and Isolator	1. Overhead Equipments (OHE) • Principles of Design of OHE - Composition of OHE - Height of Contact Wire - Contact Wire Gradient - Encumbrances - Span Length • Automatic Weight Tension and Temperature Compensation • Effect of Speed on OHE
1.3	State the location and functions of Un-insulated and Insulated Overlaps, Neutral Section, Section Insulator and Isolator	1. Un-insulated and Insulated Overlaps, 2. Neutral Section, 3. Section Insulator and Isolator
	Unit-2 Electric Locomotives	**Hrs12 Marks 16**
2.1	Know types of Electric Locomotives By Nomenclature	1. Nomenclature of Electric Locomotives

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

2.2	Draw power circuit of Electric Locomotive and state the functions of various constituents of it. State the various Equipments in Auxiliary Circuit and their functions	2. Power Circuit Diagram of AC Locomotive • Equipments in Power Circuit and their Functions - Circuit breaker and Earthling Switch - Tap Changer - Traction Transformer - Rectifier: Rectifier Connections - Smoothing Reactor • Equipments in Auxiliary Circuit & their Functions - Head Light - Flasher Light - Horn - Marker Light - Batteries - Arno Converter - Blowers - Exhausters - Compressors - Selsyn transformer
2.3	Explain the fundamentals of three phase Locomotive	3. Power Circuit of Three Phase Locomotive PWM control of Induction motors
2.4	State the function and purpose of different types of relays and contactors.	4. List and Function of Different Type of Relays List and Purpose of Different Type of Contactors
Unit-3 Train Lighting and Air conditioning		**Hrs 08 Marks 06**
3.1	State and explain different methods of train lighting	1. Train Lighting - Systems of Train Lighting - Special Requirements of Train Lighting - Method of obtaining Unidirectional Polarity - Method of obtaining Constant Output - Single Battery System. - Double Battery Parallel Block System. - Failure of under frame Generating Equipments. - End on Generation.
3.2	Understand the concept of Railway coach air conditioning	2. Railway coach air conditioning - Requirements, - Types of installations, - Air conditioned rolling stock, - Air conditioning equipments on coaches.
Unit-4 Signaling and Supervisory Control		**Hrs 08 Marks 12**
4.1	Appreciate the importance of signaling. State different types of signals and their meanings	1. Signaling - Requirements of Signaling System - Types of Signals - Colour Light Signals - Three and Four Aspects of Colour Light Signals. - Track Circuits- DC Track Circuit and AC Track Circuit - Solid State Interlocking

		- Automatic Warning systems - CAB signaling - Signaling at level crossings
	Understand Systems of Remote Control	2. Supervisory Control - Advantages of Remote Control - Systems of Remote Control - DC versus Voice Frequency (VF) Signaling - Remote Control System Equipment and Network - Mimic Diagram - Control Desk for TPC - Remote control switching equipments, - The F.M.V.F.T. ,Power supply, - Controlled station equipment, - Supervisory and alarm facilities, - Frequency allocation.
	SECTION-2	
	Unit-5 Protection of Electric Locomotive	**Hrs 10 Marks 12**

5.1	Appreciate the importance of protection of Electric Locomotive,
	Explain various types of protections provided to Electric Locomotive
		Protection of Electric Locomotive
		- Broad Strategy For Protection
		- Surge Protection:
		  - Direct Lightening Strokes
		  - Switching Surges: External and Internal
		- Overload Protection of Main Power Circuit
		- Earth Fault Protection of Power and Auxiliary Circuit
		- Protection from Over Voltage and Under Voltage
		- Differential Current Protection of Traction Circuits.
		- Protection against High and Low Air Pressure in the Air Circuit
		- Temperature Monitoring
		- Protection against Accidental Contact with H.T. Equipment
		- Protection against Fires

	Unit-6 Maintenance of Electric Locomotive	**Hrs 10 Marks 12**
6.1	Appreciate the importance of maintenance of Electric Locomotive, Describe the maintenance policies of Electric Locomotives and state them	Maintenance of Locomotive - Need of Maintenance and Policy of Obsolescence - Defects - Ideal Maintenance - Means to Improve the Reliability of Locomotive - Means to Improve Availability of Locomotive - Means to Reduce Maintenance Cost - Maintenance Record. - Characteristics of Efficient Maintenance - Electrical Faults and Their Causes

		- Fault Localization - Necessity of Testing- Testing Procedure, Individual Equipment Tests
Unit-7 Modern Trends in Electric Traction		**Hrs 12 Marks 16**
7.1	State new Developments in the Area of Electric Traction, Explain the working of Linear Electric Motor (LEM) Traction System, and State the Levitation Schemes used in Wheel less Traction System	1 LEM Propelled Traction - Linear Electric Motor (LEM) - Linear Induction Based Traction System - Moving Primary Fixed Secondary Single Sided LIM - Moving Secondary Fixed Primary Single Sided LIM - Moving Primary Fixed Secondary Double Sided LIM - Strengths and Weaknesses of LIM Propelled Railway Traction - Practical Possibilities of LIM Propelled Transportation - Inputs/Modifications for Adoption of LIM-Propulsion in the Existing System: - Track Modification, Vehicle - Modification. Voltage and Speed Control,
7.2	Understand the concept of , Metro system and Monorail system.	- Introductory features of Metro system, - Factors Influencing Adoption of LIM for Underground Metro Rail - Suspended Monorail and Straddle Monorail systems - Comparison between Long run train, Metro system and Monorail system. - Wheel-less Traction - Levitation Schemes

List of Practical/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment
1	**PP:** Visit to A.C. locomotive and draw (on half imperial sheet) for power circuit and study main components in power circuit of A.C. locomotive.
2	**PP:** Visit to locoshed and a. Develop maintenance chart for locomotive. Also list out electrical faults, which are occurring in locomotive. b. Study the protection and control systems used in locomotive.
3	**PP:** Visit the train lighting a.c. sections and a. Study the general and A/C coach lighting diagram. b. Develop maintenance charts for train lighting and A/C system in coach.
4	**PP:** Visit to signal and telecommunication section of Indian railway and study signaling system in railway.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	**Overhead Equipments**	Lecture Method, Q/A technique
2.	**Electric Locomotives**	Lecture Method, Q/A technique, Visit to Locoshed
3.	**Train Lighting and Air conditioning**	Lecture Method, Q/A technique, Visit to train lighting section
4.	**Signaling and Supervisory Control**	Lecture Method, Q/A technique
5.	**Protection of Electric Locomotive**	Lecture Method, Q/A technique
6.	**Maintenance of Electric Locomotive**	Lecture Method, Q/A, technique, Visit to Locoshed
7.	**Modern Trends in Electric Traction**	Lecture Method, Q/A, technique

Text Books:

Sr. No	Author	Title	Publication
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons.
2	J. Upadhyay, S. N. Mahendra	Electric Traction	Allied Publishers Ltd.

Reference Books:

Sr. No	Author	Title	Publication
1.	J. B. Gupta	Utilization of Electrical Energy	Kataria Publication

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	**Overhead Equipments**	02	02	02	06
2	**Electric Locomotives**	06	06	04	16
3	**Train Lighting and Air conditioning**	02	02	02	06
4	**Signaling and Supervisory Control**	04	04	04	12
5	**Protection of Electric Locomotive**	04	04	04	12
6	**Maintenance of Electric Locomotive**	08	02	02	12
7	**Modern Trends in Electric Traction**	06	06	04	16

Mrs. M.H. Bilgi
(Prepared By)

A. S. Zanpure
(Secretory,PBOS)

Mrs.M.A.Chigteri
(Chairman,PBOS)

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

Government polytechnic, Pune

GS1

Department of Electrical Engineering

Sample path for regular 2014 admitted I[st] Shift in 180S

Course Code	Course Title	Pre-requisite	Teaching Scheme				Exam Scheme						
			L	P	T	C	PA	TH	TW	OR	PR	TOT	
HU181	ENGLISH		2	2	--	4	20	80	25	0	0	125	
SC181	APPLIED MATHEMATICS - I		3	0	1	4	20	80	0	0	0	100	
SC183	ENGINEERING PHYSICS		3	2	0	5	20	80	0	0	50	150	
CM286	COMPUTER FUNDAMENTALS		1	2	0	3	0	0	25	0	50	75	I[st] Semester
ME284	ENGINEERING DRAWING		2	2	0	4	0	0	50	0	0	50	
WS281	WORKSHOP PRACTICE		0	4	0	4	0	0	50	0	0	50	
NC481	DEVELOPMENT OF SOFT SKILLS - I		0	2	0	2	0	0	25	0	0	25	
Total				11	14	1	26	60	240	175	0	100	
HU182	COMMUNICATION SKILLS		2	2	0	4	20	80	0	25	0	125	
SC182	APPLIED MATHEMATICS - II		3	0	1	4	20	80	0	0	0	100	
SC184	ENGINEERING CHEMISTRY		3	2	0	5	20	80	0	0	50	150	
AM281	ENGINEERING MECHANICS		4	2	0	6	20	80	25	0	0	125	II[nd] Semester
CM287	C PROGRAMMING		2	2	0	4	0	0	0	0	50	50	
EE281	BASIC ELECTRICAL ENGINEERING		3	2	1	6	20	80	0	0	50	150	
EE385	ELECTRICAL MATERIALS AND WORKSHOP		1	2	0	3	0	0	50	0	0	50	
Total			18	12	2	32	100	400	75	25	150	750	
ET281	BASIC ELECTRONICS		4	2	0	6	20	80	25	0	50	175	
ME285	FUNDAMENTALS OF MECHANICAL ENGINEERING		2	2	0	4	0	0	0	50	0	50	
SC282	ENGINEERING MATHEMATICS		2	0	1	3	20	80	0	0	0	100	
EE382	ELECTRICAL CIRCUITS AND NETWORKS		3	2	1	6	20	80	0	0	50	150	III[rd] Semester
EE383	ELECTRICAL MEASUREMENTS		3	2	0	5	20	80	0	0	50	150	
EE387	ELECTRICAL MACHINES - I		3	2	1	6	20	80	0	0	50	150	
AU481	ENVIRONMENTAL SCIENCE@		0	2	0	2	0	0	50	0	0	50	
Total			17	12	3	32	100	400	75	50	200	825	

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

EE381	MINI PROJECT		0	2	0	2	0	0	25	25	0	50	
EE384	ELECTRICAL POWER GENERATION		3	1	0	4	20	80	0	25	0	125	
EE386	COMPUTER AIDED ELECTRICAL DRAWING AND MODELLING		0	2	0	2	0	0	0	0	50	50	
EE388	TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER		3	2	0	5	20	80	0	25	0	125	
EE389	INSTRUMENTATIO N AND CONTROL		3	2	0	5	20	80	0	25	0	125	
ET390	DIGITAL ELECTRONICS AND MICROPROCESSO R	ET281	3	2	0	5	20	80	0	0	50	150	IVth Semester
MA482	INDUSTRIAL ORGANISATION AND MANAGEMENT		3	0	0	3	20	80	0	0	0	100	
AU483	RENEWABLE AND SUSTAINABLE ENERGY MANAGEMENT		2	0	0	2	20	80	0	0	0	100	
NC482	DEVELOPMENT OF SOFT SKILLS - II		0	2	0	2	0	0	25	0	0	25	
Total			17	13	0	30	120	480	50	100	100	850	
EE481	PROJECT AND SEMINAR	90 credits	0	4	0	4	0	0	50	0	0	50	
EE482	POWER ELECTRONICS AND DRIVES	ET281	3	2	0	5	20	80	0	25	0	125	
EE483	A.C. MACHINES	EE387	3	2	1	6	20	80	0	0	50	150	
EE485	SWITCHGEAR AND -PROTECTION		4	2	0	6	20	80	0	25	0	125	
EE486	ELECTRICAL ESTIMATION AND COSTING	EE385	2	2	1	5	20	80	0	25	0	125	Vth Semester
EE487	UTILISATION OF ELECTRICAL ENERGY		3	2	0	5	20	80	0	25	0	125	
[illegible]488	ENERGY AUDIT AND CONSERVATION	EE383	3	2	0	5	20	80	0	25	0	125	
Total			19	16	2	37	120	480	50	125	50	825	

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016

EE481	PROJECT AND SEMINAR		0	4	0	4	50	0	0	50	0	100	
EE484	TESTING AND MAINTENANCE OF ELECTRICAL EQUIPMENT	EE483	4	2	0	6	20	80	0	25	0	125	
			Any three from following										
EE581	PLC AND SCADA	EE483	3	2	1	6	20	80	0	0	50	150	
EE582	INDUSTRIAL CONTROL AND CONTROL PANEL DESIGN	EE483	3	2	1	6	20	80	0	50	0	150	
EE583	ELECTRICAL MACHINE DESIGN	EE483	3	2	1	6	20	80	0	50	0	150	VIth Semester
EE584	MICROCONTROLLER AND APPLICATIONS	ET390	3	2	1	6	20	80	0	0	50	150	
EE585	ILLUMINATION ENGINEERING	EE487	3	2	1	6	20	80	0	50	0	150	
EE586	ELECTRICAL BUILDING MAINTENANCE SYSTEM	EE487	3	2	1	6	20	80	0	50	0	150	
EE587	MODERN ELECTRIC TRACTION	EE487	3	2	1	6	20	80	0	50	0	150	
		Total	12	12	3	27	130	320	0	225	0	675	
		Grand Total	**94**	**79**	**11**	**184**	**630**	**2320**	**425**	**525**	**600**	**4500**	

Elect. Engineering Deptt.
Government Polytechnic
Pune 411 016