GOVERNMENT POLYTECHNIC NASHIK

(AN ACADEMICALLY AUTONOMOUS INSTITUTE OF GOVT. OF MAHARASHTRA)

CURRICULUM 2016

DIPLOMA PROGRAMME
IN
ELECTRICAL ENGINEERING

INDEX

PREFACE

Government Polytechnic, Nashik is established in 1980. The institute has been conferred an academically autonomous status in 1995 by Government of Maharashtra because of excellent performance.

The vision of the institute is to be a premier technical training and development institute catering to the skill and professional development in multi-domain for successful employment / self-employment by offering certified and accredited NSQF compliant programmes. The institute shall be the center for excellence in skill development and community development through different training programmes, business incubation and entrepreneurship development. For this the institute is committed to provide education for skill development, engineering diploma and continuing education programmes for enhancement of employability skills of the aspirants in the job/self-employment through continually developing quality learning systems. The institute aims at holistic and student centric education in collaboration with business, industry and having practice based education. To achieve this continuous efforts are made to design the curriculum considering the latest development in the industrial sector and technology.

The three year Diploma Programme in Electrical Engineering is being offered since 1995 under academic autonomy, first curriculum was implemented in 1995 and subsequently it was revised and implemented in 2001, 2007 and 2011. The curriculum revision is a regular activity and outcome based education approach is adopted for designing the curriculum. The revised outcome based curriculum is designated as "Curriculum 2016". The implementation of Curriculum 2016 will be effective from the academic year 2016- 17.

For designing the curriculum, the various domains have been identified. For Electrical Engineering Programme these domains are Power, Service and Maintenance, Manufacturing and Production, Public Sector and Entrepreneurship. The questionnaire has been designed to get the responses from these domain areas from different stake holders i.e. industries, teachers and students. The feedback from different stake holders has been analysed and roles, functions, activities, tasks and attitudes necessary for Diploma Electrical Engineer have been identified. The programme structure is finalised and the content detailing of individual course has been carried out by group of experts, and approved by Programme Wise Committee (PWC), Board of Studies (BOS) and Governing Body (GB).

In this Curriculum-2016, the student has to acquire 200 credits for successful completion of Diploma Programme. The courses of curriculum are structured at different 5 levels i.e. Foundation Courses, Basic Technology Courses, Allied Courses, Applied Technology Courses and Diversified Courses.

The minimum entry level is 10th. However, the curriculum provides "Multi Point Entry and Credit system (MPEC)" for the students opting admission after passing 12th, ITI, MCVC. At higher entry level, the students will get exemptions in certain courses as per the rules.

There is a flexibility for opting the courses as per the choice of students. The curriculum provides "Sample Path" as a guide line for selection of courses in each term for entry level as 10th. The List of Courses for Award of Class after completion of Diploma Programme is prescribed separately in this curriculum.

The fulfilment of programme outcome as stated in the Curriculum-2016 will depend on its effective implementation. The teachers who are implementing the curriculum were also involved in the design process of curriculum, hence, I hope that the Curriculum-2016 will be implemented in effective way and the passouts will acquire the requisite knowledge and skills to satisfy the industrial needs.

(Prof. DNYANDEO PUNDALIKRAO NATHE)
Principal
Government Polytechnic, Nashik

GOVERNMENT POLYTECHNIC NASHIK

VISION

To be a premier technical training and development institute catering to the skill and professional development in multi-domain for successful employment/self-employment by offering certified and accredited NSQF compliant programmes. The institute shall be the center for excellence in skill development and community development through different training programmes, business incubation and entrepreneurship development.

MISSION

The Government Polytechnic Nashik, an autonomous institute of Government of Maharashtra has the mission to provide education for skill development, engineering diploma and continuing education programmes for enhancement of employability skills of the aspirants in the job/self-employment through continually developing quality learning systems. The institute aims at holistic and student centric education in collaboration with business, industry and having practice based education.

ELECTRICAL ENGINEERING DEPARTMENT

VISION

To be the center of excellence in the development of manpower, entrepreneurship and technology meeting the diverse needs of the customer. The department shall be the technology centre for electrical engineering works thereby meeting the skill and testing requirements in the electrical engineering technology in business and industry.

MISSION

Department of Electrical Engineering is committed

M1. To provide diploma level technical education so as to equip learners with skills related to entrepreneurship, lifelong learning and employability.
M2. To disseminate knowledge with practical exposure ensuring, ethical, professional and safety Practices to meet the needs of industry and society.
M3. To be updated through self evaluation and continuous improvement.
M4. To be acquainted with the modern trends and technology in electrical engineering field through testing and consultancy work and continuing education.

JOB PROFILE OF DIPLOMA ELECTRICAL ENGINEERS

A Diploma Electrical Engineer has to carry out various activities in various areas during his implementation of engineering knowledge.

Electrical Engineering job opportunities are available in following domains

a. Power Sector (Generation, Transmission and Distribution)
b. Service and Maintenance
c. Manufacturing and Production
d. Public Sector
e. Entrepreneurship.

In above domain areas Diploma Electrical Engineer has to perform following duties.

1. Technician
2. Supervisor
3. Engineer in MAHAGENCO, MAHATISCOM, MAHADISCOM & other Electricity companies
4. Maintenance Engineer in small & medium industries
5. Instructor in various Electrical Workshops & Institutes
6. Service Engineer
7. Maintenance / Quality assurance supervisor
8. Production Supervisor
9. Operator for critical machines
10. Engineer in Railway Department
11. Store/ Purchase Officer
12. Sales & Marketing Engineer
13. Electrical Contractor
14. Entrepreneur

DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING

RATIONALE

The growing utilization of the electricity is a decisive prerequisite for fast developments in industry and society. With the rapid expansion of the technology over the last few decades, the demand of skilled manpower in Electrical Engineering field has risen.

Diploma Electrical Engineers are well positioned in engineering areas to serve societies in sectors like energy, drives, illumination, transportation, health, smart technologies and automation and control. The program aims to achieve measurable and observable, goals and learning experiences for technicians and engineers working in industry, society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Be a practicing electrical engineer and entrepreneur in fields of power, Manufacturing, maintenance, testing and service sectors.
II. Fulfill the needs of society in solving technical problems using engineering principles, tools and practices ethically.
III. Demonstrate life-long learning and leadership skills in the workplace and function professionally in a globally competitive world.

PROGRAMME OUTCOMES (POs)

The diploma holder from the department of Electrical Engineering has the following abilities, knowledge, characteristics and skills:

a. **Basic Knowledge:** An ability to apply knowledge of mathematics, science, and engineering

b. **Discipline Knowledge:** An ability to identify, formulate, and solve electrical engineering problems.

c. **Experiments and Practices:** An ability to design and conduct electrical experiments, as well as to analyze and interpret data.

d. **Engineering Tools:** An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.

e. **The Engineer and Society:** Understand and serve the technical needs of society.

f. **Environment and Sustainability:** Adhere to the electrical safety and environmental norms considering sustainability while executing the work.

g. **Ethics:** An understanding of the professional and ethical responsibility.

h. **Individual and Teamwork:** An ability to function in multidisciplinary teams.

i. **Communication:** An ability to communicate effectively.

j. **Project Management and Finance:** Demonstrate knowledge and understanding engineering and management principals to manage projects in multidisciplinary environment.

k. **Lifelong Learning:** Understand need and engage in lifelong learning for technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On successful completion of Diploma Programme in Electrical Engineering, the student will be able to,

PSO 1. Identify and analyze technological problem in the field of electrical Engineering by applying knowledge of basic science, mathematics and electrical engineering fundamentals.

PSO 2. Able to implement maintenance schedule and operation in electrical engineering systems using significant technical skills.

PSO 3. Apply managerial skills and safety practices in electrical engineering work culture.

MAPPING OF PEO'S / PO'S/ COURSES

MAPPING OF MISSION AND PROGRAMME EDUCATIONAL OBJECTIVES

Sr. No.	Mission	Component of Mission Statement	PEO/s
1	M1	To provide diploma level technical education so as to equip learners with skills related to entrepreneurship, lifelong learning and employability.	I, II, III
2	M2	To disseminate knowledge with practical exposure ensuring, ethical, professional and safety Practices to meet the needs of industry and society.	I, II
3	M3	To be updated through self evaluation and continuous improvement.	I, III
4	M4	To be acquainted with the modern trends and technology in electrical engineering field through testing and consultancy work and continuing education.	I, II, III

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOME

Sr. No.	Programme Educational Objectives (PEOs)	Programme Outcomes (POs)
1	I. Be a practicing electrical engineer and entrepreneur in fields of power, Manufacturing, maintenance, testing and service sectors.	a, b, c, e, h, i, j, k
2	II. Fulfill the needs of society in solving technical problems using engineering principles, tools and practices ethically.	d, e, g, f
3	III. Demonstrate life-long learning and leadership skills in the workplace and function professionally in a globally competitive world.	g, h, i, j, k

MAPPING OF PROGRAMME SPECIFIC OUTCOMES AND PROGRAMME OUTCOME

Sr. No.	Programme Specific Outcomes (PSOs)	Programme Outcomes (POs)
1	I. Identify and analyze technological problem in the field of electrical Engineering by applying knowledge of basic science, mathematics and electrical engineering fundamentals.	a, b, e, k
2	II. Able to implement maintenance schedule and operation in electrical engineering systems using significant technical skills.	b, c, d, f, g
3	III. Apply managerial skills and safety practices in electrical engineering work culture.	h, i, j, k

MAPPING OF PROGRAMME OUTCOME AND COURSES

Sr. No.	Programme Outcome (POs)	Courses
a	**Basic knowledge:** An ability to apply knowledge of mathematics, science, and engineering.	Basic Mathematics Engineering Mathematics Applied Physics Applied Chemistry Engineering Graphics Fundamentals of Electronics Basic Mechanical Engineering Applied Mathematics
b	**Discipline knowledge:** An ability to identify, formulate, and solve electrical engineering problems.	Engineering Mechanics Basic Electrical Engineering Electrical Network Electrical Measurement and Instrumentation Analog and Digital Electronics DC Machines and Transformers Electrical Material and Workshop Switchgear and Protection Special Purpose Electrical Machines Electrical Safety Electrical Installation A.C. Machines Generation and Transmission of Electrical Power
c	**Experiments and practice:** An ability to design and conduct electrical experiments, as well as to analyze and interpret data.	Engineering Graphics Workshop Practice Basic Mechanical Engineering Electrical Safety Analog and Digital Electronics A.C. Machines Switchgear and Protection Testing and Maintenance of Electrical Machines Power Electronics
d	**Engineering Tools:** An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	Computer Programming Engineering Graphics Workshop Practice Computer Aided Graphics Electrical Material and Workshop Special Purpose Electrical Machines Testing and Maintenance of Electrical machines Microcontroller and Applications Electrical Machine Design Industrial Automation and Control Electrical Drives and Control
e	**The engineer and society:** Understand and serve the technical needs of society.	Environmental Studies Entrepreneurship Development Renewable Energy Sources Electrical Installation System

Sr. No.	Programme Outcome (POs)	Courses
		Distribution and Utilisation of Electrical Energy Electrical Energy Management Project Microcontroller and Applications Industrial Automation and Control Advanced Power System Traction Engineering Illumination Engineering
f	**Environment and sustainability:** Adhere to the electrical safety and environmental norms considering sustainability while executing the work.	Environmental Studies Renewable Energy Sources Electrical Energy Management Electrical Safety
g	**Ethics:** An understanding of the professional and ethical responsibility.	Development of Life Skills Professional Practices Material Management Marketing Management Industrial Organisation and Management Electrical Safety Supervisory Skills
h	**Individual and team work:** An ability to function in multidisciplinary teams.	Development of Life Skills Industrial Organisation and Management Entrepreneurship Development Supervisory Skills Professional Practices Seminar Project Testing and Maintenance of Electrical Machines Generation and Transmission of Electrical Power Electrical Installation Systems Electrical Energy Management
i	**Communication:** An ability to communicate effectively.	Communication Skills Development of Life Skills Industrial Organisation and Management Entrepreneurship Development Supervisory Skills Marketing Management Professional Practices Seminar
j	**Project Management and Finance:** Demonstrate knowledge and under-standing engineering and management principals to manage projects in multidisciplinary environment.	Entrepreneurship Development Project Industrial Organization and Management Material Management Marketing Management Electrical Installation Systems Electrical Energy Management

Sr. No.	Programme Outcome (POs)	Courses
		Microcontroller and Applications
k	**Life-long learning**: Understand need and engage in lifelong learning for technological change.	Development of Life Skills Professional Practices Computer Aided Graphics Computer Programming Renewable energy Sources Electrical Safety Testing and Maintenance of Electrical Machines Seminar Project

PROGRAMME - DIPLOMA IN ELECTRICAL ENGINEERING
CURRICULUM STRUCTURE

SCHEME AT A GLANCE

Level	Name of Level	Total Number of Courses offered	Number of Courses to be completed	TH	TU	PR	Total Credits	Marks
Level-1	Foundation courses	12	12 Compulsory	35	02	26	63	1400
Level-2	Basic Technology	07	07 Compulsory	19	01	18	38	750
Level-3	Allied courses	09	05 (03 Compulsory +02 Electives)	10	---	04	14	400
Level-4	Applied Technology	11	11 Compulsory	32	01	28	61	1350
Level-5	Diversified Technology	08	04 Electives	16	---	08	24	600
TOTAL		**47**	**33 Compulsory +06 Electives 39**	**112**	**04**	**84**	**200**	**4500**
Grand Total		**47**	**39**	**112**	**04**	**84**	**200**	**4500**

Abbreviations:
TH : Theory, TU : Tutorial, PR: Practical.

PROGRAMME - DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL – 1
FOUNDATION COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6101	Communication Skills	CMS	03	---	02	05	03	80	20	---	---	50	150
02	6102	Development of Life Skills	DLS	01	---	02	03	---	---	---	---	---	50	50
03	6103	Basic Mathematics	BMT	03	01	---	04	03	80	20	---	---	---	100
04	6104	Engineering Mathematics	EMT	03	01	---	04	03	80	20	---	---	---	100
05	6105	Applied Physics	PHY	04	---	02	06	02	80#	20#	---	---	50	150
06	6106	Applied Chemistry	CHY	04	---	02	06	02	80#	20#	---	---	50	150
07	6107	Engineering Graphics	EGR	02	---	04	06	---	---	---	25	---	25	50
08	6108	Engineering Mechanics	EMH	04	---	02	06	03	80	20	---	---	50	150
09	6109	Workshop Practice	WSP	---	---	06	06	---	---	---	---	---	50	50
10	6110	Basic Electrical Engineering	BEE	04	---	02	06	03	80	20	25	---	25	150
11	6111	Fundamentals of Electronics	FEX	04	---	02	06	03	80	20	---	---	50	150
12	6112	Basic Mechanical Engineering	BME	03	---	02	05	03	80	20	---	--	50	150
TOTAL			--	**35**	**02**	**26**	**63**	**---**	**720**	**180**	**50**	--	**450**	**1400**

Level : 1

Total Courses : 12
Total Credits : 63
Total Marks : 1400

Abbreviations :

Abbr : Course Abbreviation, TH : Theory, TU : Tutorial, PR: Practical, OR : Oral, TW : Term Work.

Course code Indication :

Example : 6101
First digit : 6 : Indicates last digit of Year of Implementation of Curriculum
Second digit : 1 : Indicates Level.
Third & Fourth digit : 01 : Indicates Course Number.

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiner only.
4) # Indicates Online Examination

PROGRAMME – DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL – 2
BASIC TECHNOLOGY COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6201	Computer Aided Graphics	CAG	---	---	04	04	---	---	---	---	---	50	50
02	6228	Analog and Digital Electronics	ADE	04	---	02	06	03	80	20	25	---	25	150
03	6229	Electrical Network	ENW	04	01	02	07	03	80	20	25	---	25	150
04	6230	Electrical Measurement and Instrumentation	EMI	04	---	02	06	03	80	20	---	---	25	125
05	6231	DC Machines and Transformers	DCT	04	---	02	06	03	80	20	25	---	25	150
06	6232	Electrical Material and Workshop	EMW	02	---	04	06	---	---	---	---	25	50	75
07	6233	Computer Programming	CPR	01	---	02	03	---	---	---	25	---	25	50
TOTAL			--	**19**	**01**	**18**	**38**	**---**	**320**	**80**	**100**	**25**	**225**	**750**

Level: 2

Total Courses : 07
Total Credits : 38
Total Marks : 750

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME – DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL – 3
ALLIED COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6301	Applied Mathematics	AMT	03	---	---	03	03	80	20	---	---	---	100
02	6302	Environmental Studies	EVS	---	---	02	02	---	---	---	---	---	50	50
03	6303	Industrial Organization and Management	IOM	03	---	---	03	03	80	20	---	---	---	100
Elective I : Any **ONE** of the following														
04	6305	Supervisory Skills	SSL	03	---	---	03	03	80	20	---	---	---	100
	6306	Marketing Management	MKM	03	---	---	03	03	80	20	---	---	---	100
	6307	Material Management	MMT	03	---	---	03	03	80	20	---	---	---	100
Elective II : Any **ONE** of the following														
05	6309	Entrepreneurship Development	EDP	01	---	02	03	---	---	---	---	---	50	50
	6310	Renewable Energy Sources	RES	01	---	02	03	---	---	---	---	---	50	50
	6314	Electrical Safety	ESY	01	---	02	03	---	---	---	---	---	50	50
TOTAL			--	**10**	---	**04**	**14**	**---**	**240**	**60**	**---**	**---**	**100**	**400**

Level: 3

Total Courses : 05
Total Credits : 14
Total Marks : 400

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME – DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL – 4
APPLIED TECHNOLOGY COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6410	Professional Practices	PPR	---	---	04	04	---	---	---	---	---	50	50
02	6411	Seminar	SEM	---	---	02	02	---	---	---	---	---	50	50
03	6412	Project	PRO	---	---	04	04	---	---	---	---	50	50*	100
04	6426	Electrical Installation Systems	EIS	04	---	04	08	03	80	20	---	25	25	150
05	6427	AC Machines	ACM	04	01	02	07	03	80	20	25	---	25	150
06	6428	Generation and Transmission of Electrical Power	GTP	04	---	---	04	03	80	20	---	---	---	100
07	6429	Switchgear and Protection	SGP	04	---	04	08	03	80	20	---	25	25	150
08	6430	Testing and Maintenance of Electrical Machines	TME	04	---	02	06	03	80	20	---	25	25	150
09	6431	Special Purpose Electrical Machines	SPM	04	---	02	06	03	80	20	25	---	25	150
10	6432	Distribution and Utilization of Electrical Energy	DUE	04	---	02	06	03	80	20	---	---	50	150
11	6433	Electrical Energy Management	EEM	04	---	02	06	03	80	20	---	25	25	150
TOTAL			--	**32**	**01**	**28**	**61**	**---**	**640**	**160**	**50**	**150**	**350**	**1350**

Level: 4

Total Courses : 11
Total Credits : 61
Total Marks : 1350

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME – DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME STRUCTURE
LEVEL – 5
DIVERSIFIED COURSES

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
Elective III : Any **THREE** of the following														
01 02 03	6529	Microcontroller and Applications	MCA	04	---	02	06	03	80	20	---	25	25	150
	6530	Industrial Automation and Control	IAC	04	---	02	06	03	80	20	---	25	25	150
	6531	Advanced Power System	APS	04	---	02	06	03	80	20	---	25	25	150
	6532	Traction Engineering	TRE	04	---	02	06	03	80	20	---	25	25	150
	6533	Illumination Engineering	ILE	04	---	02	06	03	80	20	---	25	25	150
Elective IV : Any **ONE** of the following														
04	6534	Power Electronics	PEX	04	---	02	06	03	80	20	---	25	25	150
	6535	Electrical Machine Design	EMD	04	---	02	06	03	80	20	---	25	25	150
	6536	Electrical Drives and Control	EDC	04	---	02	06	03	80	20	---	25	25	150
TOTAL			---	**16**	---	**08**	**24**	**---**	**320**	**80**	**---**	**100**	**100**	**600**

Level: 5

Total Courses : 04
Total Credits : 24
Total Marks : 600

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME – DIPLOMA IN ELECTRICAL ENGINEERING
Class Award Courses

Sr. No.	Course Code	Course Title	Course Abbr	TEACHING SCHEME				EXAMINATION SCHEME						
				TH	TU	PR	Total Credits	Theory Paper		Test	PR	OR	TW	Total
								Hrs	Mark					
01	6303	Industrial Organization and Management	IOM	03	---	---	03	03	80	20	---	---	---	100
02	6411	Seminar	SEM	---	---	02	02	---	---	---	---	---	50	50
03	6412	Project	PRO	---	---	04	04	---	---	---	---	50	50*	100
04	6429	Switchgear and Protection	SGP	04	---	04	08	03	80	20	---	25	25	150
05	6430	Testing and Maintenance of Electrical Machines	TME	04	---	02	06	03	80	20	---	25	25	150
06	6431	Special Purpose Electrical Machines	SPM	04	---	02	06	03	80	20	25	---	25	150
07	6432	Distribution and Utilization of Electrical Energy	DUE	04	---	02	06	03	80	20	---	---	50	150
08	6433	Electrical Energy Management	EEM	04	---	02	06	03	80	20	---	25	25	150
Any **THREE** from **Elective III**														
09	6529	Microcontroller and Applications	MCA	04	---	02	06	03	80	20	---	25	25	150
10	6530	Industrial Automation and Control	IAC	04	---	02	06	03	80	20	---	25	25	150
11	6531	Advanced Power System	APS	04	---	02	06	03	80	20	---	25	25	150
	6532	Traction Engineering	TRE	04	---	02	06	03	80	20	---	25	25	150
	6533	Illumination Engineering	ILE	04	---	02	06	03	80	20	---	25	25	150
Any **ONE** From **Elective IV**														
12	6534	Power Electronics	PEX	04	---	02	06	03	80	20	---	25	25	150
	6535	Electrical Machine Design	EMD	04	---	02	06	03	80	20	---	25	25	150
	6536	Electrical Drives and Control	EDC	04	---	02	06	03	80	20	---	25	25	150
TOTAL			--	**39**	**---**	**26**	**65**	**---**	**800**	**200**	**25**	**225**	**350**	**1600**

Total Courses : 12
Total Credits : 65
Total Marks : 1600

Assessment of PR / OR / TW :

1) All orals & practicals are to be assessed by external & internal examiners.
2) * Indicates TW to be assessed by external & internal examiners.
3) Other TW are to be assessed by internal examiners.

PROGRAMME - DIPLOMA IN ELECTRICAL ENGINEERING
SAMPLE PATH
ENTRY LEVEL- 10+

Nature of Course	First Year		Second Year		Third Year		Total
	Odd Term	**Even Term**	**Odd Term**	**Even Term**	**Odd Term**	**Even Term**	
Compulsory	6102 (03) DLS	6101 (05) CMS	6111 (06) FEX	6201 (04) CAG	6303 (03) IOM	6412 (04) PRO	
	6103 (04) BMT	6104 (04) EMT	6229 (07) ENW	6228 (06) ADE	6410 (04) PPR	6430 (06) TME	
	6105 (06) PHY	6106 (06) CHY	6230 (06) EMI	6426 (08) EIS	6411 (02) SEM	6433 (06) EEM	
	6107 (06) EGR	6109 (06) WSP	6231 (06) DCT	6427 (07) ACM	6429 (08) SGP		
	6108 (06) EMH	6110 (06) BEE	6232 (06) EMW	6428 (04) GTP	6431 (06) SPM		
	6112 (05) BME	6233 (03) CPR	6301 (03) AMT		6432 (06) DUE		
		6302 (02) EVS					
Total credits (Compulsory)	**30**	**32**	**34**	**29**	**29**	**16**	**170**
Elective	--	--	--	**Elective I (**Any **ONE)** 6305(3) SSL 6306(3) MKM 6307(3) MMT **: (03)** **Elective II (**Any **ONE)** 6309(3) EDP 6310(3) RES 6314(3) ESY **: (03)**	**Elective IV (**Any **ONE)** 6534(6) PEX 6535(6) EMD 6536(6) EDC **: (06)**	**Elective III (**Any **THREE)** 6529(6) MCA 6530(6) IAC 6531(6) APS 6532(6) TRE 6533(6) ILE **: (06)**	--
Total Credits (Elective)	--	--	--	**06**	**06**	**18**	**30**
Total Courses	**06**	**07**	**06**	**07**	**07**	**06**	**39**
Total Credits (Compulsory + Elective)	**30**	**32**	**34**	**35**	**35**	**34**	**200**
Grand Total of Credits							**200**

Note : Figures in bracket indicates total credits.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Communication Skills (CMS) **COURSE CODE** : 6101

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Proficiency in English is one of the basic needs of technical students hence this curriculum aims at developing the functional and communicative abilities of the students. As Communication skills play a decisive role in the career development and entrepreneurship this course will guide and direct to develop a good personality and effective communication too. This course is compiled with an aim of shaping minds of engineering students while catering to their needs.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand & use basic concepts of Communication in an organisation and social context.
2. Use reasonably and grammatically correct English language with reading competency.
3. Utilise the skills to be a competent communicator.
4. Develop comprehension skills, improve vocabulary and acquire writing skills.
5. Overcome language and communication barriers with the help of effective communication techniques.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply the process and identify types of Communication for being an effective communicator
2. Identify the barriers in the communication process and apply ways to overcome them
3. Interpret graphical information precisely
4. Use formal written skills for business correspondence.
5. Exhibit listening & reading skills for improving competencies in communication.
6. Pronounce English sounds with correct stress and intonation in day to day conversations.
7. Construct correct grammatical sentences in oral and written communication.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Communication**	1a. Define communication & objectives 1b. Describe the process of Communication 1.a. Differentiate between types of communication	1.1 Meaning of communication: definition, objectives and Importance of communication 1.2 Elements/Process of communication 1.3 Types of communication: Formal, Informal, Verbal, Nonverbal, vertical, Horizontal, Diagonal	04
Unit-II **Communication**	2a. Explain types of barriers 2b. Describe the	2.1 Barriers to Communication a) Physical Barrier • Environmental(time, noise,	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Barriers	principles of effective communication 2c. Discuss ways to overcome barriers. 2d. Identify various barriers	distance and surroundings) • Personal(deafness, stammering, ill-health, spastic, bad handwriting, temporary physical disabilities) b) Mechanical: Machines/means oriented c) Psychological : Day dreaming prejudice, emotional, blocked mind, generation gap, status, inactiveness, perception d) Language: Difference in language, technical jargons pronunciation and allusion 2.2 Ways to overcome barriers 2.3 Principles of effective communication	
Unit-III **Nonverbal & Graphical communication**	3a. Explain use of body language in oral conversations 3b. Label and interpret the graphical information correctly 3c. Describe the importance of graphical and nonverbal methods in technical field.	3.1 Non-verbal codes: • Proxemics • Chronemics • Artefacts 3.2 Aspects of body language(Kinesics) 3.3 Graphical communication • Advantages and disadvantages of graphical communication • Tabulation of data and its depiction in the form of bar graphs and pie charts.	06
Unit-IV **Formal Written Communication**	4a. Develop notices, circulars and emails 4b. Draft letters on given topics 4c. Prepare technical reports. 4d. Develop various types of paragraphs.	4.1 Office Drafting :Notice, Memo, Circulars and e-mails 4.2 Job application and resume 4.3 Business correspondence : Enquiry, Reply to an enquiry order, complaint, adjustment, 4.4 Technical Report Writing : Accident report, Fall in Production / survey, progress Investigation / maintenance 4.5 Paragraph writing -Types of paragraphs • Descriptive • Technical • Expository	12
Unit-V **Listening skills**	5a. Differentiate between hearing and listening. 5b. Apply techniques of effective listening.	5.1 Listening versus hearing 5.2 Merits of good listening 5.3 Types of listening 5.4 Techniques of effective listening	02
Unit-VI **Reading Skills**	6a. Describe various methods to develop vocabulary	6.1 Reading for comprehension 6.2 Reading styles 6.3 Developing vocabulary 6.4 Methods of word formation: prefixes,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	6b. Develop reading competencies. 6c. Explain steps to comprehend passage	suffixes, collocations, synonyms, antonyms, Homophones, Homonyms. 6.5 Comprehension of unseen passages	
Unit-VII **Speaking Skills**	7a. Demonstrate Correct Pronunciation, stress and intonation in everyday conversation 7b. Develop formal conversational techniques. 7c. Deliver different types of speech	7.1 Correct Pronunciation -Introduction to sounds vowels, consonants, stress, intonation 7.2 Conversations : • Meeting & Parting • Introducing & influencing requests • Agreeing & disagreeing • Formal enquiries 7.3 Speech-Types of speech • Welcome Speech • Farewell speech • Vote of thanks	06
Unit-VIII **Language Grammar**	8a. Use grammatically correct sentence in day to day oral and written communication 8b. Distinguish between determiners & apply correctly in communicative use 8c. Use correct verb for given course. 8d. Use appropriate preposition as per time, place and direction. 8e. Transform the sentences.	8.1 Tense • Present Tense(Simple, Continuous, perfect, perfect Continuous) • Past Tense(Simple, Continuous, perfect, perfect Continuous) • Future Tense(Simple) 8.2 Determiners • Articles (A, An, The) • Some, Any, Much, Many, All, Both, Few, A few, The few, Little, A little, The little, Each, Every. 8.3 Modal Auxiliaries Can, Could, May, Might, Shall, Should, Will, Would, Must, Have to, Need, ought to 8.4 Sentence Transformation • Voice • Degree • Affirmative, Negative, Assertive, 8.5 Prepositions • Time • Place • Direction 8.6 Conjunctions	08
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Communication	--	02	04	06
II	Communication Barriers	02	02	02	06
III	Nonverbal & Graphical communication	--	02	08	10
IV	Formal Written Communication	--	04	18	22
V	Listening Skills	--	--	04	04

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
VI	Reading Skills	--	02	06	08
VII	Speaking Skills	02	02	04	08
VIII	Language Grammar	**--**	04	12	16
	TOTAL	**04**	**18**	**58**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Communicate on the given topic/situation.	02
2	II	Identify communication barriers	02
3	III	Non-verbal communication	02
4	IV	Business letter writing &job application	02
5	IV	Draft official letter	02
6	IV	Technical report writing on given topic	04
7	V	Attend a seminar and preparing notes	02
8	VI	Vocabulary building with different methods	02
9	VII	Language lab Experiment for correct pronunciation of sounds	04
10	VII	Write & present conversations on given situations	02
11	VIII	Grammar application-various exercises on grammar	04
12	I to VIII	Mini project (on given topic)	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts on types of communication.
2. Convert language information in graphical or nonverbal codes.
3. Maintaining own dictionary of difficult words, words often confuse, homophones & homonyms.
4. Listening daily English news on television or radio & to summarise it in their language.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Use audios of correct pronunciations.
2. Show videos about use of body language in oral formal conversations

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Effective English Communication	Krishna Mohan and Meenakshi Raman	Tata McGraw Hill Publishing Co. Ltd.
2	English for practical purpose	Z. N. Patil	Macmillan
3	Spoken English	Basal and Harrison	Orient Longman
4	Contemporary English Grammar	R. C. Jain, David Green	Macmillan
5	Business correspondence and Report writing	R. C. Sharma and Krishna Mohan	Tata McGraw Hill Publishing
6	English Communication for Polytechnics	S. Chandrashekhar & others	Orient Black Swan
7	Active English Dictionary	S. Chandrashekhar & others	Longman

B) Software/Learning Websites

1. http://www.communicationskills.co.in
2. http://www.mindtools.com
3. http://www.communication.skills4confidence
4. http://www.goodcommunication skills.net
5. http://www.free-english-study.com/
6. http://www.english-online.org.uk/
7. http://www.englishclub.com
8. http://www.learnenglish.de
9. http://www.talkenglish.com/
10. http://www.englishgrammarsecrets.com
11. http://www.myenglishpages.com/
12. http://www.effective-business-letters.com/
13. http://www.englishlistening.com/
14. http://www.class-central.com

C) Major Equipments/ Instruments with Broad Specifications

1. Digital English Language Laboratory.
2. Computers for language laboratory software
3. Headphones with microphone

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1									H		M
CO2									H		M
CO3	M								H		M
CO4		M							H		M
CO5	M								H		M
CO6		M							H		
CO7	M								H		M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL /AE / DD / ID
COURSE : Development of Life Skills (DLS) **COURSE CODE :** 6102

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

This course will develop the student as an effective member of the team in the organization. It will develop the abilities and skills to perform at highest degree of quality. It enhances his/her capabilities in the field of searching, assimilating information, handling people effectively and solving challenging problems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team.
2. Enhance capabilities in the field of searching, assimilating information, managing the given task, handling people effectively and solving challenging problems.
3. Understand and use personal management techniques.
4. Analyse their strengths, weaknesses, opportunities and threats.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Analyse self attitude and behaviour.
2. Acquire self learning techniques by using various information sources
3. Identify personal strengths to get future opportunities.
4. Develop presentation skills with the help of effective use of body language.
5. Enhance leadership traits and recognise the importance of team work.
6. Face interview without fear
7. Resolve conflict and solve problems by appropriate methods.
8. Set the goal for personal development.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Self Analysis**	1a. Explain types of Motivation. 1b. Differentiate between types of attitude. 1c. Describe types of behaviour 1d. Analyse SWOT of an individual	1.1 Motivation-types, need 1.2 Attitude-types, tips for developing positive attitude 1.3 Behaviour-types-passive, assertive, aggressive 1.4 Confidence building-need, importance 1.5 SWOT analysis-(significance)	02
Unit-II **Self Learning**	2a. Explain the self learning techniques by enhancing	2.1 Need & importance of SLT 2.2 Information source-Primary, secondary, tertiary	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Techniques (SLT)	memory and concentration 2b. Apply practical skills for effective learning 2c. Identify the information sources	2.3 Enhancing Memory and concentration 2.4 Learning Practical Skills- need of Practical Skills types of practical skills-technical, organisational, human Domains of learning 1)cognitive 2)Affective 3)psychomotor 2.5 information search techniques-library search, internet search	
Unit-III **Self Development & management**	3a. Explain the Need of self Management 3b. Set the goals for personal development	3.1 Stress management-remedies to avoid, minimize stress 3.2 Health management –importance of Diet & exercise 3.3 Time management-time planning, tips for effective time management 3.4 Goal setting-need and importance 3.5 Creativity	03
Unit-IV **Emotions**	4a. Explain nature and types of human emotions 4b. Differentiate between cognitive and emotional intelligence	4.1 Basic emotions- 4.2 Emotional intelligence 4.3 Emotional stability/maturity	01
Unit-V **Presentation skills**	5a. Develop presentation skills with the help of body language 5b. Describe utilisation of voice quality in oral conversations	5.1 Body Language – Codes, dress and appearance, postures, gestures Facial expressions 5.2 Voice and language 5.3 Use of aids:-OHP, LCD projector, white board	02
Unit-VI **Group discussion and interview techniques**	6a. Participate in group discussion 6b. Face interview without fear.	6.1 introduction to group discussion 6.2 ways to carry group discussion 6.3 Parameters-analytical, logical thinking, Decision making 6.4 Interview techniques Necessity, tips for handling common questions	02
Unit-VII **Team work**	7a. Recognise the importance of team work 7b. Enhance leadership qualities	7.1 stages of team development 7.2 Understand and work with dynamic group 7.3 Ingredients of effective teams. 7.4 leadership in teams, handling frustration in group	02
Unit-VIII **Conflicts & Problem Solving**	8a. Describe sources of conflicts and resolve conflicts 8b. Develop lateral thinking abilities 8c. Identify innovative methods in solving Problems.	8.1 sources of conflict 8.2 Resolution of conflict 8.3 ways to enhance interpersonal relation 8.4 Steps in problem solving 8.5 Problem solving techniques-trial, error & brainstorming	02
		TOTAL	**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Self Introduction-giving personal details for introducing self	02
2	II	SLT-Access the book on biography of scientist/industrialist/invention from the library or internet	02
3	I	Deliver a seminar for 10 minutes using presentation aids.	02
4	IV	Prepare PowerPoint slides on given topic and make presentation	02
5	VII	Case study for problem solving in an organisation	04
6	V	Discuss a topic in a group & prepare minutes of discussion.	02
7	VI	Prepare questionnaire for your friend or any person in the organisation to check emotional intelligence.	02
8	VII	Goal setting for achieving the success-SMART goal.	02
9.	I	SWOT Analysis for yourself with respect to your Strength, Weakness, Opportunities & Threats	04
10	III	Attend a seminar or a guest lecture and note down the important points and prepare a report of the same.	02
11	VIII	Undertake any social activity in a team and prepare a report about it(i.e. tree plantation, blood donation, environment protection, rain water harvesting)	04
12	III	Management of self-stress management, time management, health management	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Preparing personal time table.
2. Performing YOGA as a routine part of daily life.
3. Practicing breathing exercises.
4. Improving concentration by chanting and meditation.
5. Focusing on behavior skills and mannerism
6. Searching information on internet and newspapers.
7. Concentrating on various aspects of personality development.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Use of videos on personality development.
2. Use of power point presentation on health, time & stress management
3. Case study of an organization
4. Use of videos to show interviews of successful personalities.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Make Every Minute Count	Marion E Haynes	Kogan Page India
2	Body language	Allen Pease	Sudha Publication Pvt. Ltd.
3	Presentation Skills	Michael Hatton	ISTE New Delhi
4	Organizational Behavior	Pearson Education Asia	Tata McGraw Hill
5	Working in Teams	Chakravarty, Ajanta	Orient Longman
6	Develop Your Assertiveness	Bishop, Sue	Kogan Page India
7	Adams Time Management	Marshall Cooks	Viva Books
8	Time Management	Chakravarty, Ajanta	Rupa and Company
9	Target setting & Goal Achievement	Richard hale, Peter whilom	Kogan page India
10	Creativity &problem solving	Lowe and Phil	Kogan page (I)P Ltd
11	Basic Managerial Skills for all	E. H. Mc Grah, S. J.	Prentice Hall of India, Pvt. Ltd.

B) Software/Learning Websites

1. http://www.mindtools.com
2. http://www.successconsciousness.com
3. http://www.studyhabits.com
4. http://www.motivateus.com
5. http://www.quickmba.com
6. http://www.success77.com
7. http://www.stress.org
8. http://www.topachievement.com
9. http://www.ethics.com
10. http://www.creativityforlife.com
11. http://www.motivation.com
12. http://www.queendom.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	L	M			L		L	M	H		H
CO2	M	M			L	L	H		M		H
CO3					M		M	M	H		H
CO4	L	L			L	M	M		H		M
CO5					L		M	M	H	M	L
CO6		L			L	M			H		M
CO7	L				M	M	L	M	M	L	L
CO8	L	L			L	M	L	L	H		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Basic Mathematics (BMT) **COURSE CODE** : 6103

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	01	--	04	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

This course is classified under foundation course and intends to teach the students basic facts, concepts and principles of Mathematics, as a tool to analyse the engineering problems and lay down the understanding of basic technology courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire the knowledge of mathematical terms definitions, principles and procedure of algebra, trigonometry and co-ordinate geometry.
2. Develop the process of logical thinking.
3. Comprehend the principles of the other courses.
4. Solve problems by using analytical & systematic approach.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply logarithm concept for solving mathematical problems
2. Solve determinant and matrix
3. Solve simultaneous equation in three variables
4. Use partial fraction to solve engineering problems
5. Apply binomial theorem to solve engineering problems
6. Determine properties of triangle and solution of triangle
7. Use coordinate geometry for solving problems in straight lines and circles

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Logarithm**	1a. Define logarithm use it for conversion 1b. Apply laws of logarithm to solving problems 1c. Identify common logarithm and Naperian logarithm	1.1 Concept and definition of Logarithm, conversion of exponential and logarithmic forms 1.2 Laws of logarithms and change of base formula 1.3 Common logarithm and **Naperian** logarithm definition and **notation only.**	03
Unit-II **Determinant & Matrix Algebra**	2a. Calculate determinant of order two and three and apply Cramer's Rule. 2b. Calculate area Of Triangle & condition of co linearity	2.1 Determinant of order two and three, Cramer's Rule for Three Variables. Area of Triangle and Condition of Co linearity. 2.2 Definition of a matrix, types of matrix, algebra of matrices, equality of matrices, scalar multiplication, product	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2c. Define various types of matrices; solve problems using Algebra of matrix. 2d. Calculate Inverse of matrix	of two matrices, Transpose of matrix. 2.3 Minor, cofactor and ad joint of matrix, Inverse of matrix by ad Joint matrix method.	
Unit-III **Partial Fraction**	3a. Identify proper & improper 3b. Resolve partial fraction method of Case I, Case II and Case III.	3.1 Rational function, proper and Improper rational Functions 3.2 Concept of partial fraction. Case-1 The denominator contains linear non repeated factors. Case-2 the denominator contains linear but repeated factors Case-3 the denominator contains quadratic irreducible factors	05
Unit-IV **Binomial Theorem**	4a. State Binomial Theorem for Positive integral Index. 4b. Use T_{R+1} for finding middle term general term 4c. Use approximation Theorem for solving problems	4.1 Binomial Theorem for positive integral index, formula for Tr+1, Middle term, particular term. 4.2 Binomial Theorem for rational and negative index (expansion up to four terms only), approximation theorem, simple problems	04
Unit-V **Measurement Of Angle**	5a. Conversion of sexagesimal systems & circular systems	5.1 Measurement of angles, sexagesimal systems & circular systems, co-terminal angles, positive and negative angles, conversion of angle to radian to degree and degree to radians.	02
Unit-VI **Trigonometric Ratios**	6a. Calculate trigonometric ratios of any angle, Solve problem using fundamental Identities. 6b. Solving problem using allied, Compound, Multiple and Sub multiple forms.	6.1 Trigonometric ratios of any angle, graph of trigonometric functions fundamental identities 6.2 Trigonometric ratios of allied, compound, multiple and sub multiple angles, sum &product forms.	08
Unit-VII **Inverse Trigonometric Functions**	7a. Convert & solving inverse trigonometry function 7b. Use of $\tan^{-1} x + \tan^{-1} y$ form to solve problem.	7.1 Concept and definition of trig. Function, Relation between inverse trig. functions	02
Unit-VIII **Properties Of Angle And Solution Of Triangle**	8a. Use properties of triangle : Sine rule, Cosine rule to solve mathematical problems 8b. Solve any triangle problems	8.1 Sine rule, cosine rule & law of tangent (simple problems) 8.2 solutions of triangle	04
Unit-IX **Equation Of**	9a. Calculate Slope, X and Y, intercept Use various form of	9.1 Slope and intercepts of straight line, various form of straight line, angle between two lines, condition for two	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Straight Line	Straight line to solve problems.	parallel or perpendicular lines, perpendicular distance formula, distance between two parallel lines.	
Unit-X **Equation Of Circle**	10a. Calculate Radius & Centre of general circle 10b. Apply various form of circle 10c. Calculate Equation of tangent & normal to the circle.	10.1 Equation Of std. circle, center radius form, general form of circle, Diameter form of circle, equation of tangent and normal to the circle.	04
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS

Unit No.	Unit Title	Distribution of Marks			
		R Level	**U Level**	**A and above Levels**	**Total Marks**
I	Logarithm	02	02	02	06
II	Determinant And Matrix Algebra	04	08	04	16
III	Partial Fraction	02	04	02	08
IV	Binomial Theorem	02	02	02	06
V	Measurement Of Angle	02	02	--	04
VI	Trigonometric Ratios	04	04	04	12
VII	Inverse Trigonometric Function	02	02	--	04
VIII	Properties of Triangle And Solution Of Triangle	02	02	04	08
IX	Equation Of Straight Line	02	04	04	10
X	Equation Of Circle	02	02	02	06
	TOTAL MARKS	**24**	**32**	**24**	**80**

6.0 ASSIGNMENTS/ TUTORIAL /TASKS

Sr. No.	Unit No.	Batch wise Tutorial Exercises **Tutorial:** Ten question of multiple choice with justification	Approx. Hrs. required
1	I	Logarithm	01
2	II	Determinant	01
3	II	Matrix Algebra	02
4	III	Partial Fraction	01
5	IV	Binomial Theorem	02
6	V	Measurement And Angle	01
7	VI	Trigonometric Ratios	01
8	VI	Trigonometric Ratios	01
9	VII	Inverse Trigonometric Ratios	02
10	VIII	Properties of Triangle And Solution Of Triangle	01
11	IX	Straight Line	02
12	X	Circle	01
		TOTAL	**16**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mathematics for polytechnic student (I)	S. P. Deshpande	Pune Vidyarthi Gruha
2	Trigonometry	S. L. Loney	S. Chand
3	Higher Engineering Mathematics	B. S. Grewal	Khanna
4	College Algebra	F.G. Valles	Charter Publication.
5	Higher Algebra	H. S. Halls & S.R. Night	
6	Matrices	F. Ayers	Schan Series. Metric Edition Book, Palace of India.

B) Software/Learning Websites

1. http://www.mathsisfun.com
2. http://mathinsight.org/logarithm_basics
3. http://www.mathportal.org/linear-algebra/determinants/determinant-of-a-matrix.php
4. http://www.math.hmc.edu/calculus/tutorials/matrixalgebra/
5. http://ibgwww.colorado.edu/~carey/p7291dir/handouts/matrix.algebra.pdf
6. http://www.purplemath.com/modules/binomial2.htm
7. http://www.themathpage.com/atrig/line.htm
8. http://i1.dainikbhaskar.com/web2images/education/maths_13659_13897.pdf
9. http://mathworld.wolfram.com/InverseTrigonometricFunctions.html
10. http://aieee.examcrazy.com/maths/formula-tips/Co-ordinate-Geometry-circle.asp

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer and Internet system.
3. LCD Projector

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H		M								L
CO2	H		M								L
CO3	H		L								L
CO4	H		L								L
CO5	H		M								L
CO6	H		M								L
CO7	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Engineering Mathematics (EMT) **COURSE CODE** : 6104

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	01	--	04	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The study of mathematics is necessary to develop in the students the skills essential new for the disciplines like Genetic Engineering, Biotechnology and Information Technology etc. This course is extension of Basic Mathematics and stepping to learn applied mathematics. Engineering mathematics lays down the foundation to understand and express principles and laws involved in other technology courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire knowledge of differential calculus, vector algebra, statistics and probability, complex numbers.
2. Develop the ability to apply mathematical methods to solve engineering problem
3. Acquire sufficient mathematical techniques necessary for daily and practical problems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes :

1. Solve function and limit of function
2. Apply derivatives to solve engineering problems
3. Apply vector to solve engineering problems
4. Determine statistics probability to solve engineering problems
5. Solve engineering problems using complex number

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Function**	1a. Solve problem of functions, State even & odd function, identify various types of function.	1.1 Definition of function, types of functions, Basic functions such as algebraic, exponential, logarithmic, trigonometric, inverse trigonometric functions, explicit, implicit, composite, inverse, parametric, exponential even & odd functions, simple problems	03
Unit-II **Limits**	2a. Apply limit of various types of Functions.	2.1 Definition of limit, limit of Functions such as algebraic Functions, trigonometric functions, logarithm and exponential functions	05
Unit-III **Derivatives**	3a. Solve problems of derivative with the help of rules & formulae of derivative.	3.1 Concept and definition of derivative, Notation, standard Formulae and rules of derivative 3.2 Methods of differentiation, derivative of	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	3b. Differentiate various types of functions 3c. Calculate second order of derivative.	composite functions, implicit function. Parametric function. Inverse function. Logarithmic Differentiation. 3.3 Second order derivatives, simple problems.	
Unit-IV **Application of Derivatives**	4a. Apply geometrical meaning of derivative; solve the problem based on related rates, radius of curvature & maxima minima.	4.1 Geometric meaning of derivative 4.2 Error theorem. 4.3 Related rates, radius of curvature 4.4 Maxima & Minima	06
Unit-V **Vectors**	5a. Apply algebra of vector 5b. Calculate scalar and vector products 5c. Apply vector algebra to find work done and moment of force, Area of parallelogram	5.1 Definition of vector, position vector, algebra of vector (equality, addition, subtraction and scalar multiplication) 5.2 Dot (scalar) and vector (cross) product of two vectors. 5.3 Application of vectors, work done and moment of force about a point and line.	08
Unit-VI **Statistics & Probability**	6a. Calculate range, mean deviation, standard deviation for group and ungrouped data, coefficient of variance 6b. Apply the theory of probability to solve problem 6c. Apply addition and multiplication theorems	6.1 Measure of dispersion such as range, mean deviation, standard deviation, variation and coefficient of variation. 6.2 Definition of random experiment, sample space event, occurrence of events and types of events (impossible, mutually exclusive, exhaustive and equally likely) 6.3 Definition of probability, addition and multiplication theorems of probability.	08
Unit-VII **Complex Number**	7a. Solve problem based on complex number(real and imaginary part, polar form) 7b. Apply Algebra of complex number to solve problem 7c. Solve problem of Euler's function & circular function, Hyperbolic function.	7.1 Definition of complex number, Cartesian, polar and exponential forms of complex number. 7.2 Algebra of complex no. (equality, addition, subtraction multiplication and division) 7.3 De–Moiver's theorem (without proof) and simple problems. 7.4 Euler's form of circular functions, Hyperbolic functions and relation between them.	08
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS:

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Function	02	02	--	04
II	Limits	02	04	02	08
III	Derivative	06	08	06	20
IV	Application Of Derivative	02	04	06	12
V	Vector	04	06	02	12
VI	Statistics And Probability	04	04	04	12

Unit No.	Unit Title	Distribution of Marks			
		R Level	U Level	A and above Levels	Total Marks
VII	Complex Number	04	04	04	12
	TOTAL MARKS	**24**	**32**	**24**	**80**

6.0 ASSIGNMENTS/TUTORIAL/TASKS:

Sr. No.	Unit No.	Batch wise Tutorial Exercises (Outcomes in Psychomotor Domain) **Tutorial:** Ten question of multiple choice with justification	Approx. Hrs. required
1	I	Function	01
2	II	Limits I	01
3	II	Limits II	01
4	III	Derivative I	01
5	III	Derivative II	01
6	III	Derivative III	02
7	III	Second Order Derivative	01
8	IV	Application Of Derivative	02
9	V	Vector	02
10	VI	Statistics	01
11	VI	Probability	01
12	VII	Complex Number	02
		TOTAL	**16**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.
3. Learn graphical software: Excel, DPlot and Graph.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mathematics for polytechnic student (II)	S. P. Deshpande	Pune Vidyarthi Gruha
2	Higher Engineering Mathematics	B. S. Grewal	Khanna
3	Advanced Engineering Mathematics	H.K. Das	Khanna Publication
4	Calculus of single variable	R.T. Smith	Tata McGraw Hill.
5	Engineering Mathematics	S.S. Shastrii	Prentice Hall Publication

B) Software/Learning Websites

1. http://schools.aglasem.com/1341
2. http://www.emathzone.com/tutorials/calculus/types-of-functions.html
3. http://www.mathsisfun.com/algebra/vectors.html
4. http://www.mathsisfun.com/data/
5. http://mathworld.wolfram.com/ComplexNumber.html

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer and Internet system.
3. LCD Projector.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H		M								L
CO2	H		M								L
CO3	H		M								L
CO4	H		M								L
CO5	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Physics (PHY) **COURSE CODE :**6105

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	Online Exam Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	02	Max.	80#	20#	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

 # Indicates online examination

3.0 RATIONALE:

Physics is associated with our lives at every stage. A good scientific attitude is essential for every human being to increase his/her quality of life. Today learning Physics has become more challenging because it is no more a watertight compartment. The approach is now inter-disciplinary and integrated with emphasis on the principle with their application.

4.0 COURSE OBJECTIVES:

The student will be able to

1. Understand and apply the laws of Physics in various contexts.
2. Apply their knowledge of basic Physics to solve problems and present the solution in a clear and concise manner.
3. Acquire and develop experimental skills including the use of variety of laboratory instruments, taking of data for interpretation and its analysis.
4. Develop skill in the presentation of clear and concise written accounts of laboratory work.

5.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Differentiate between various systems of measurement and identify proper unit of a physical quantity.
2. Identify the properties of Laser and Optical fibre as well as their engineering applications.
3. Acquire the knowledge about superconductors, indoor lighting.
4. Identify conductors & insulators of heat and analyse the relation between pressure, volume and temperature of gas.
5. Recognise elastic properties of materials and types of modulus of elasticity.
6. Identify the properties such as surface tension of liquids and viscosity of fluids.
7. Be aware of the propagation of sound and acoustics of building.
8. Distinguish between various effects produced by an electric charge.
9. Gain broad ideas about capacitors, semiconductors and p-n junction diode.
10. Discover the basics and applications of photoelectric cell and X rays.

6.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Units & Measurements**	1a. Differentiate between fundamental &derived quantities/units.	1.1 Need of measurements, units of measurements, systems of units, SI units, fundamental & derived units, fundamental & derived quantities.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1b. Determine dimension of a physical quantity. 1c. Calculate different types of errors in measurements. 1d. Illustrate use of vernier caliper and screw gauge for linear measurements.	1.2 Dimension of physical quantity, dimensional analysis & its uses, order of magnitude & significant figures. 1.3 Accuracy & errors, instrumental, systematic and random error, estimation of error-average value, absolute error, relative error & percentage error, numerical. 1.4 Measuring instruments-vernier caliper and micrometer screw gauge.	
Unit-II **Light**	2a. Calculate refractive index of material of prism. 2b. Identify advantages of optical fibre over conducting wire. 2c. Differentiate between types of optical fibre. 2d. Recognise the principle of photometry. 2e. Acquire knowledge about indoor lighting.	2.1 Refraction of light, refractive index and its significance, Refraction through prism, Derivation of Prism formula. 2.2 Total internal reflection of light (TIR), Optical fibre, advantages and disadvantages, construction of optical fibre. 2.3 Transmission characteristics of Optical, fibre, types of optical fibre-step & graded index fibre, Application of optical fibre. 2.4 Luminous flux, luminous intensity, illumination, candela, lumen, illuminance, inverse square law of illuminance, principle of photometry. 2.5 Indoor lighting-direct, indirect, semi-indirect, utilization factor, efficiency of source, maintenance factor, space to height ratio, total luminous flux, numericals.	08
Unit-III **Laser**	3a. Describe the principle of laser. 3b. Acquire knowledge about He-Ne laser 3c. Identify applications of holography	3.1 Laser, Properties of laser, spontaneous absorption, spontaneous emission and stimulated emission, population inversion, pumping, life time, meta-stable-state. 3.2 Construction, advantages & disadvantages of Helium-Neon Laser, applications of Laser. 3.3 Holography recording and Reconstruction of hologram, Application of holography.	06
Unit-IV **Current Electricity**	4a. Demonstrate ohm's law, use of metre bridge to find resistance. 4b. Use potentiometer to find internal resistance. 4c. Identify positive/ Negative	4.1 Ohm's law, Specific resistance, conductance, conductivity, Wheatstone's network, balancing condition, metre bridge. 4.2 Theory of shunt, fall of potential along wire, potentiometer. 4.3 Effect of temperature on resistance of metals, semiconductors & insulators, temperature coefficient of resistance,	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	temperature coefficient of resistance of material. 4d. Calculate electrical energy consumed in kWh. 4e. Distinguish between properties of conductor & superconductor.	positive& negative temperature coefficient of resistance. 4.4 Heating effect of electric current, electric power, electric energy, kilowatt hour. 4.5 Superconductivity, graph of temperature versus resistance for mercury, superconductors, properties and application of superconductors, Numericals.	
Unit-V **Transfer of Heat & Gas laws**	5a. Illustrate conversion of temperature. 5b. Distinguish between good & bad conductors of heat on the basis of thermal conductivity. 5c. Calculate coefficients of expansion of solids. 5d. Identify the relation between pressure, volume & temperature of gas. 5e. Gain idea about specific heats of gases. 5f. Distinguish between isothermal, adiabatic, isobaric & isochoric process.	5.1 Temperature & heat, Celsius & Fahrenheit scale, conduction, convection, radiation. 5.2 Conduction of heat –variable state, steady state and temperature gradient, law of thermal conductivity, coefficient of thermal conductivity, applications of thermal conductivity. 5.3 Expansion of solids, Coefficient of linear, areal and cubical expansion and relation between them. 5.4 Statement of Boyle's law, Charle's law, Gay Lussac's law, concept of absolute zero, Kelvin scale of temperature. 5.5 General gas equation, universal gas constant, Work done in expanding a gas at constant pressure, specific heats of a gases and relation between them (equation only). 5.6 Isothermal, isobaric and isochoric and adiabatic process, difference between these processes, numericals.	08
Unit-VI **(ONLY For CE / ME / PS / AE)** **Elasticity**	6a. Differentiate between elasticity, plasticity & rigidity 6b. Calculate moduli of elasticity of materials. 6c. Illustrate applications of elasticity.	6.1 Deforming force, restoring force, elasticity, plasticity and rigidity. 6.2 Stress and strain with their types, elastic limit, Hooke's law, moduli of elasticity (Y, η, K) and their significance, Poisson's ratio. 6.3 Stress-strain diagram for wire under increasing load, factor of safety, applications of elasticity, Numericals.	06
Unit-VII **(ONLY For CE / ME / PS / AE)** **Surface Tension**	7a. Acquire knowledge about surface tension of liquids & its effects. 7b. Recognise effects of impurities & temperature on surface tension of liquid. 7c. Calculate surface	7.1 Cohesive and adhesive force, range of molecular forces, sphere of influence, surface energy, Surface tension, molecular theory of surface tension. 7.2 Effect impurities and temperature on surface tension, relation between surface tension & surface energy 7.3 Angle of contact, capillary action relation between surface tension, capillary rise, radius of capillary,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	tension of liquid.	application of surface tension, numericals.	
Unit-VIII **(ONLY For CE / ME / PS / AE)** **Viscosity**	8a. Identify applications of Pascal's law. 8b. Gain knowledge about viscosity of fluids. 8c. Find viscosity of fluids using Stoke's law 8d. Distinguish between types of flow of fluid. 8e. Identify significance of Reynold's number.	8.1 Pressure, pressure due to liquid column, hydrostatic paradox, Pascal's law and its applications. 8.2 Viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its unit. 8.3 Stoke's law, expression for relation between coefficient of viscosity and terminal velocity. 8.4 Types of flow, Streamline and turbulent flow, advantages of streamline flow. 8.5 Critical velocity, Reynold's number and its significance, Bernoulli's principle & its applications, application of viscosity, Numericals.	06
Unit-IX **(ONLY For CE / ME / PS / AE)** **Sound and acoustic**	9a. Recognise frequency of audible & other sound waves. 9b. Calculate sound intensity in decibel scale. 9c. Illustrate properties & applications of Ultrasonic waves. 9d. Calculate reverberation time using Sabine formula. 9e. Plan acoustical planning of a hall.	9.1 Introduction to sound, frequency of sound and limits of Audibility, intensity of sound. 9.2 Reflection of sound, absorption coefficient, transmission coefficient, reflection coefficient, Loudness and intensity level, threshold of hearing & pain, Decibel scale. 9.3 Ultrasonic waves-properties & applications. 9.4 Echo, Reverberation, standard reverberation time, Sabine's formula. 9.5 Condition for good Acoustics, factors affecting acoustical planning of auditorium. Numericals.	08
Unit-VI **(only for EE / IF / CM / EL)** **Electrostatics**	6a. Calculate force between two charges using Coulomb's law. 6b. Illustrate different properties of electric lines of force. 6c. Calculate electric potential due an electric charge. 6d. Identify importance of potential of earth.	6.1 Coulomb's inverse square law, permittivity of medium, unit charge, electric field, electric field intensity. 6.2 Electric lines of force and their properties, electric flux, Electric flux density and relation between them, Electric flux associated with charge. 6.3 Electric potential, potential difference, potential gradient, dielectric strength, breakdown potential, expression for PD between two points due to point charge, expression for absolute potential at point. 6.4 Potential due to charged sphere. (three cases), potential of earth, numericals.	08
Unit-VII **(only for EE /**	7a. Illustrate charging &discharging of capacitor.	7.1 Capacitor, Capacitance and its unit, dielectric, effect of dielectric, dielectric constant, dielectric breakdown,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
IF / CM / EL) **Capacitance**	7b. Calculate effective capacitance of combination of capacitors. 7c. Identify types of capacitors. 7d. Calculate energy stored by a capacitor.	Principle of capacitor. 7.2 Charging and discharging of Capacitor, Capacitor in series and parallel. 7.3 Types of capacitor- fixed & variable. 7.4 Expression for capacitance of parallel plate capacitor, capacitance of spherical and cylindrical capacitor equation only, energy stored by charged capacitor (equation only), numericals.	
Unit-VIII **(only for EE / IF / CM / EL)** **Photo electricity and X-rays**	8a. Acquire knowledge about photoelectric effect. 8b. Identify characteristics of Photoelectric effect. 8c. Calculate KE of photoelectrons using Einstein's equation. 8d. Recognise production of x-rays. 8e. Illustrate properties & applications of X-rays.	8.1 Planck's quantum theory, Photo electric effect, experiment to study photoelectric effect. 8.2 Characteristics of photoelectric effect, threshold frequency, threshold-wavelength, photoelectric work function, stopping potential. 8.3 Einstein's photoelectric equation, photoelectric Cell and types, applications of photoelectric cell. 8.4 Origin of X-rays, production of X-rays using Coolidge's X-ray tube, minimum wavelength of X-ray. 8.5 Properties of X-rays, applications of X-rays, numerical.	06
Unit-IX **(only for EE / IF / CM / EL)** **Band Theory of Solids**	9a. Classify solids on the basis of band theory. 9b. Classify Semiconductors. 9c. Illustrate forward & reverse bias of P-N Junction diode.	9.1 Energy bands in solids-valence band, conduction band and forbidden energy gap, classification of solids on the basis of band theory : conductor, insulator and semiconductor. 9.2 Properties of semiconductor, classification of semiconductors intrinsic & extrinsic, P type & N type semiconductors. 9.3 P-N junction diode, forward & reverse bias characteristics of P-N junction diode, advantages of semiconductor devices.	06
		TOTAL	**64**

7.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
Units common for all programmes					
I	Units and measurements	04	02	04	10
II	Light	02	04	04	10
III	Laser	02	04	02	08
IV	Current electricity	02	04	04	10
V	Transfer of heat & gas laws	02	04	04	10

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
Units ONLY FOR CE/ME/PS/AE					
VI	Elasticity	02	04	02	08
VII	Surface tension	02	04	02	08
VII	Viscosity	02	02	04	08
IX	Sound and Acoustics	02	02	04	08
Units ONLY FOR EE/IF/CM/EL					
VI	Electrostatics	02	04	02	08
VII	Capacitance	02	04	02	08
VIII	Photo electricity & X-rays	02	02	04	08
IX	Band theory of solids	02	02	04	08
	TOTAL	**20**	**30**	**30**	**80**

Legends: R = Remembrance (Knowledge); U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

8.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.
Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
		Common practicals	
1	I	Measure the dimensions of different objects using Vernier caliper	02
2	I	Measure the dimensions of different objects using micrometer screw gauge	02
3	II	Determine the refractive index of material of prism using spectrometer	02
4	IV	Verify ohm's law and determine resistivity of material of given wire.	02
5	IV	Verify law of resistance in series & parallel using metre bridge.	02
6	V	Determine coefficient of linear expansion using Pullinger's apparatus.	02
7	V	Verify Boyle's law	04
8	IV	Verify principle of potentiometer.	02
		Practicals for CE/ME/PS/AE	
1	VI	Verify Hooke's law of elasticity and determine Young's modulus of material of wire using Searle's apparatus.	04
2	VII	Determine surface tension of water using capillary rise method.	02
3	VIII	Verify Stoke's law of viscosity and determine coefficient of viscosity of given fluid.	04
4	IX	Determine coefficient of absorption of sound of given acoustical material.	04

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
		Practicals for EE/IF/CM/EL	
1	VII	Verify law of capacitance in series/parallel.	02
2	VII	Charging & discharging of capacitor and determine its time constant.	04
3	VIII	To study I-V characteristic of photoelectric cell.	04
4	IX	To study I-V characteristics of PN junction diode in forward/reverse biased condition.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts of Vernier caliper, screw gauge, travelling microscope, spherometer & spectrometer for lab demonstration.
2. Study acoustical planning of institute's auditorium hall.
3. Study lighting system of institute's conference hall.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show videos based on topics in the curriculum (total internal reflection, population inversion, different laws of physics) for better understanding of the concepts.
2. Show videos of practical demonstration before performance of practical for better understanding of practical.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering Physics	R K Gaur & S L Gupta	Dhanpat Rai Pub.
2	Applied Physics	Prof. Arthur Beiser	Tata McGraw hill Pub.
3	Engineering Physics	D K Bhattacharya	Oxford University press
4	Physics	Halliday & Resnick	Wiley India

B) Software/Learning Websites

1. www.physicsclassroom.com
2. www.physics.org
3. www.physics.brown.edu
4. http://scienceworld.wolfram.com/physics/
5. http://hyperphysics.phy-astr.gsu.edu/hbase
6. www.msu.edu/~brechtjo/physics
7. http://www.rp-photonics.com/laser_applications.html
8. http://webphysics.davidson.edu/alumni/jimn/He-Ne/Pages/Theory.htm
9. http://physix_jun.tripod.com/fibres_4.htm
10. http://www.suite101.com/content/optics-total-internal-reflection-a51310
11. http://teachers.web.cern.Ch/teachers/archiv/HST2001/accelerators/superconductivity/superconductivity.htm
12. http://en.wikipedia.org/wiki/Acoustics

C) Major Equipments/ Instruments with Broad Specifications

1. Vernier Caliper (LC = 0.02mm)
2. Micrometer screw gauge (LC = 0.01mm)
3. Aneroid barometer.
4. Digital stop watch.
5. Travelling Microscope.
6. Regulated power supply.
7. Apparatus to verify Boyles law.

8. Stoke’s App to measure viscosity.
9. Metre bridge.
10. Searle's apparatus for Young’s modulus.
11. Pullinger's apparatus.
12. Gas burner with regulator, LPG gas cylinder and lighter
13. Spectrometer.
14. Bunsen’s photometer.
15. Ammeter, voltmeter, galvanometer, rheostat, resistance box
16. Potentiometer.

10.0 MAPPING MATRIX OF PO’S AND CO’S:

Course Outcomes	**Programme Outcomes**										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H		M	M	L			H	L		L
CO2	H		M	L	L			M	L		
CO3	H		M	L	L			M			
CO4	H	M	M	L	M	L		M			L
CO5	H	M	M	L	M			M			
CO6	H	M	L	L	M			M			
CO7	H		L	L	M	L		M	L		L
CO8	H		M	L	M			L	L		
CO9	H		M	L	M			M	L		
CO10	H		L	L	M	L		L	L		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Chemistry (CHY) **COURSE CODE** : 6106

TEACHING & EXAMINATION SCHEME

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	Online Exam. Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	-	02	06	02	Max.	80#	20#	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

 # indicates online examination

1.0 RATIONALE:

Chemistry is the basic science course which is essential to all engineering programmes. The basic aim of teaching science is to develop in the students the habit of scientific inquiry, ability to establish the cause and effect. The study of basic concepts of chemistry like atomic structure, water treatment, metals and alloys, corrosion, lubricants, non metallic materials, fuels, environmental effects etc. will help the students to understand engineering courses where the emphasis is laid on the application of these concepts. Teaching of chemistry should be aimed at developing the right type of aptitude in the students and the ability to predict the result under given conditions.

Thus good foundation in basic science will help the students in their self development to cope up with continuous flow of innovation.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop scientific attitude in students.
2. Apply knowledge of chemistry in engineering situations.
3. Develop in students the habit of scientific enquiry, ability to establish cause and effect.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply the principles of chemistry to engineering situations.
2. Apply knowledge to correlate the properties of materials, their engineering uses and protection.
3. Write electronic configuration of various elements.
4. Apply various applications of electrolysis in engineering situations.
5. Illustrate various methods of softening of hard water.
6. Use the appropriate metals and alloys for different engineering applications.
7. Differentiate various types of corrosion and gain knowledge on control measures associated with corrosion
8. Select lubricants for machines.
9. Enlist the various characteristics of good fuel.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
Unit-I **Atomic Structure**	1a. Describe structure of an atom 1b. Explain Bohr's theory and distinguish between orbit and orbital	1.1 Structure of an atom, fundamental particles of an atom, concept of atomic number, mass number. 1.2 Bohr's theory, orbit, orbital, shapes of orbital, energy level, sub energy level	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
	1c. Describe rules for arrangement of electrons 1d. Give electronic configuration 1e. Describe the different types of compounds 1f. Explain the formation of various electrovalent and covalent compounds	1.3 Hund's rule, Aufbau principle, Rules for distribution of electrons in shell and subshells. 1.4 Electronic configuration of atoms having atomic number 1-30 1.5 Electrovalent and covalent compounds, electrovalency and covalency 1.6 Formation of covalent compound e.g. H_2O, CH_4, O_2, N_2, C_2H_2 1.7 Formation of electrovalent compound e.g. NaCl, $CaCl_2$, $AlCl_3$	
Unit-II **Electro chemistry**	2a. Explain basic concepts of electrochemistry. 2b. Explain theory of ionization and factors affecting it 2c. Explain mechanism of electrolysis with examples. 2d. Describe faraday's first and second laws and solve numerical. 2e. Explain the applications of electrolysis 2f. Describe the construction and working of cells	2.1 Definition of electrochemistry, atom, ion, electrode, cell, electrolysis, electrolytes, non-electrolytes, anode, cathode. 2.2 Arrhenius theory of ionization, degree of ionization, factors affecting degree of ionization. 2.3 Electrolysis, mechanism, electrolysis of fused NaCl, aqueous NaCl using platinum electrode, $CuSO_4$ solution using Copper electrode. 2.4 Faraday's first and second law, 2.5 Numericals on Faraday's laws. 2.6 Process of electroplating and electro refining 2.7 Types of cell- e.g. Dry cell, Ni-Cd cell, introduction to solar cell	08
Unit-III **Water**	3a. Explain sources, impurities, properties of water. 3b. Differentiate between hard and soft water 3c. Describe the ill effect of hard water in domestic and industrial field 3d. Explain the different methods for removal of hardness of water. 3e. Describe the different treatments of drinking water 3f. Explain the concept of pH and pOH numerical related with it, applications of pH in engineering.	3.1 Sources of water- Rain, surface, underground water. Impurities in water- suspended, colloidal, dissolved, biological 3.2 Physical and chemical properties of water. 3.3 Hard and soft water. Types of hardness of water, Salts producing hardness of water, Units of hardness of water. 3.4 Domestic field- cooking, washing, bathing, drinking. Industrial field- paper, textile, dye, sugar industry. 3.5 Temporary hardness- boiling, Clark's method. 3.6 Permanent hardness- Permutit's method, ion exchange method. 3.7 Methods of purification of water: Screening, Sedimentation, coagulation, filtration, Sterilization of water. 3.8 Definition of pH and pOH, pH scale and numerical. 3.9 Applications of pH in engineering. -city water supply, corrosion, effluent treatment, electroplating.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
Unit-IV **Metals**	4a. Explain the basic concepts of metallurgy. 4b. Describe different characteristics of metal. 4c. Explain the metallurgy of iron. 4d. Describe the physical properties and applications of metals.	4.1 Definition of ore, mineral, gangue 4.2 Hardness, toughness, brittleness, tensile strength, malleability, ductility, machinability, weldability 4.3 Flow sheet of metallurgy 4.4 Steps of metallurgy : a. Concentration: physical, chemical. b. Reduction: smelting, alumino thermic process. c. Refining: poling, liquation, distillation, electrorefining. 4.5 Physical properties and applications of Fe, Cu, Al, Cr, Ni, Sn, P	08
Unit-V **Alloys**	5a. Describe the meaning of alloy, its preparation and its purposes of formation. 5b. Explain the classification of alloys and their applications	5.1 Definition of alloy, different methods of preparation of alloy, 5.2 Purposes of formation of an alloy. 5.3 Classification of alloys • Ferrous alloy- alloys steel and its applications. • Non ferrous alloy-Copper alloy-brass, bronze, gun metal, Monel metal Aluminum alloy-Duralumin • Solder alloy and its types.	06
Unit-VI **Corrosion**	6a. Describe magnitude of corrosion, meaning of corrosion, types of corrosion 6b. Explain the factors affecting the atmospheric and immersed corrosion 6c. Explain different methods of protection of metal from corrosion	6.1 Magnitude of corrosion, definition of corrosion, types of corrosion- a) Atmospheric corrosion- definition, types – b) corrosion due to oxygen, mechanism of corrosion due to oxygen, nature of film and its role in corrosion process c) Corrosion due to other gases 6.2 Immersed corrosion- definition, it's mechanism, galvanic and concentration cell corrosion 6.3 Factors affecting atmospheric and immersed corrosion 6.4 Methods of protection of metal from corrosion- hot dipping, metal spraying, sherardizing, electroplating of metal cladding, organic coating-paints and varnish	10
Unit-VII **Lubricants**	7a. Describe lubricants, its function and classification of lubricants. 7b. Explain lubrication and it's types 7c. Describe physical and chemical properties of lubricants 7d. Explain selection of lubricants for various	7.1 Definition of lubricant, function of lubricants, classification of lubricants. 7.2 Definition of lubrication, types of lubrication 7.3 Physical properties- viscosity, viscosity index, oiliness, flash and fire point, volatility, cloud and pour point. 7.4 Chemical properties- acid value, saponification value, emulsification. 7.5 Properties and names of lubricants used for various machines like delicate	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hours
	machines	instruments, heavy load and low speed machine, gears, cutting tools, I.C. Engine, steam engine	
Unit-VIII **Fuels**	8a. Describe fuels, characteristics of good fuel, types of fuel 8b. Describe solid fuel-e.g. coal in detail 8c. Describe liquid fuel e.g. -petroleum 8d. Describe gaseous fuel their advantages 8e. Distinguish between solid liquid and gaseous fuels	8.1 Definition of fuel, characteristics of good fuel, classification of fuel 8.2 Solid fuel-e.g. coal, it's types, properties of good coal, selection of coal, analysis of coal, determination of C and H in coal 8.3 Liquid fuel-e.g. petrol, classification of petrol, refining of petrol 8.4 Gaseous fuel e.g. LPG, natural gas, biogas 8.5 Advantages of gaseous fuel over solid and liquid fuels 8.6 Comparison between solid, liquid and gaseous fuels	08
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No	Unit title		Distribution of Theory marks			
			R level	U level	A level	Total
1	Atomic Structure		04	02	02	08
2	Electrochemistry		04	04	04	12
3	Water		04	04	04	12
4	Metals		04	02	04	10
5	Alloys		02	02	02	06
6	Corrosion		04	02	06	12
7	Lubricants		04	02	04	10
8	Fuels		04	02	04	10
	TOTAL		**30**	**20**	**30**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1 to 5	I	Inorganic qualitative analysis of any five solutions	10
6	II	Determination of electrochemical equivalent of copper.	02

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
7 to 8	III	Strength of given acidic solution using standard base solution.	04
9	III	Determination of pH of different unknown solutions.	02
10	III	Determination of chloride content in given water sample.	02
11 to 12	III	Determination of hardness of water	04
13	V	Determination of % of Fe in given ferrous alloy sample.	02
14	VI	To find relation between decrease in weight due to corrosion of metal and time.	02
15	VII	Determination of viscosity of given lubricating oil.	02
16	VIII	Determination of % of moisture in given coal sample by proximate analysis.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Draw structures and write electronic configurations of atoms having atomic number 1-30.
2. Testing of water samples.
3. Sampling and collection of coal.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. CAI package, video demonstration, charts, models, visits and expert seminar/lecture.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Books	Author	Publication
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons
2	A Text Book of Polytechnic Chemistry	V. P. Mehta	Jain Brothers
3	Engineering Chemistry	S. S. Dara	S. Chand Publication
4	Industrial Chemistry	B. K. Sharma	Goel Publication
5	Environmental Chemistry & Pollution control	S. S. Dara	S. Chand Publication
6	Engineering Chemistry	M. M. Uppal	Khanna Publisher New Delhi

B) Software/Learning Websites

1. http://chemistry.osu.edu/~woodward/ch121/ch2_atoms.htm
2. http://www.nyu.edu/pages/mathmol/textbook/atoms.html
3. www.chemguide.co.uk/atoms/properties/gcse.html
4. http://www.water-research.net/index.php/water-treatment/tools/hard-water-hardness
5. http://www.unitedutilities.com/documents/WaterhardnessFactSheet.pdf
6. http://www.explainthatstuff.com/alloys.html
7. http://www.gordonengland.co.uk/xcorrosion.htm
8. http://cuiet.info/notes/chemistry/Lubricants.pdf
9. http://www.ignou.ac.in/upload/unit-3.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Muffle furnace
2. Distillation Plant
3. Computer lab with 20 Computers for online theory exam.
4. Digital pH meter
5. Ostwald's viscometer
6. Electronic weighing balance (0 to 100gm capacity).

7. Digital Stop watch.
8. Lovibond comparator
9. Regulated DC power supply
10. Rheostat
11. Ammeter

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M	M		L			L			L
CO2	H		M	M	L						L
CO3	H			M							L
CO4	H			M							L
CO5	H	M	L		M			L			
CO6	H	M		M	M						L
CO7	H			M	M						L
CO8	H			M	M						L
CO9	H										L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / EE / IF / CM / EL / AE
COURSE : Engineering Graphics (EGR) **COURSE CODE** : 6107

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
02	--	04	06	--	Max.	--	--	--	25	--	25	50
					Min.	--	--	--	10	--	10	--

1.0 RATIONALE:

Engineering Graphics is the language of engineers. The concepts of Engineering Graphics are used to develop & express the ideas and convey the instructions, which are used to carry out jobs in the Engineering field. This preliminary course aims at building a foundation for the further course in drawing and other allied courses.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the use of drawing tools and equipments.
2. Understand the significance of engineering curves for various applications.
3. Understand the projections of point and line inclined to one reference plane.
4. Interpret the pictorial view and understand orthographic projection of the simple object.
5. Interpret the orthographic projection and understand pictorial view of the simple object.
6. Understand the significance of sectional view in the drawing.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Draw the engineering curves for given engineering applications.
2. Draw the projections of point and lines inclined to one reference plane only.
3. Draw and dimension orthographic projections of given object.
4. Interpret orthographic projections of object and draw isometric view.
5. Draw sectional view of simple objects as per IS convention.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Drawing instruments and their uses**	1a. Use Instruments for drawing, Scales, Lines, & their applications.	1.1 Letters and numbers (single stroke vertical) 1.2 Convention of lines and their applications. 1.3 I.S. codes for planning and layout. 1.4 Scale (reduced, enlarged & full size) plain scale and diagonal scale. 1.5 Sheet layout. 1.6 Geometrical constructions and drawing polygons	04
Unit-II **Engineering curves**	2a. Draw Conic curves, involutes, Cycloid. 2b. State the applications of engineering curves.	2.1 Methods for drawing an ellipse concentric circle, directrix focus and arc of circle method. 2.2 Methods for drawing parabola by directrix focus and rectangular method. 2.3 Methods for drawing a hyperbola by	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		directrix focus and rectangular method. 2.4 Procedure for drawing involutes of circle and polygon (up to hexagon) 2.5 Procedure for drawing cycloid, epicycloid and hypocycloid	
Unit-III **Projections of Point and Line**	3a. Draw the projection of point 3b. Draw projection of line	3.1 Projection of point in the different quadrants. 3.2 Projection of line parallel to one plane and inclined to another reference plane only.	04
Unit-IV **Orthographic Projections**	4a. Interpret & draw orthographic views from given pictorial view.	4.a Concept of Orthographic projections. 4.b Conversion of pictorial view into Orthographic views only first angle projection method for simple objects.	06
Unit-V **Isometric Projections**	5a. Interpretation of isometric view. 5b. Draw isometric view from given orthographic views	5.1 Use of Isometric scale. 5.2 Comparison of true scale with isometric scale 5.3 Conversion of orthographic views into isometric View / projection	06
Unit-VI **Sectional View**	6a. Draw sectional view of simple drawing	6.1 Representation of sectional plane 6.2 Conversion of orthographic views into sectional View	04
		TOTAL	**32**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (Theory)

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Two sheet on letters, numbers and representation of lines and redraw the figures.	08
2	II	Sheet on six engineering curves	12
3	III	Sheet on projections of line. (04 problems)	12
4	IV	Sheet on orthographic projection.(02 problems)	12
5	V	Sheet on isometric views and projection. (04 problems)	12
6	VI	Sheet on sectional view. (02 problems)	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the information about application of engineering curves.
2. Sketch the orthographic views of simple engineering product in sketch book.
3. Sketch isometric view of simple engineering product in sketch book.
4. Sketch sectional view of simple engineering product in sketch book.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show Three Dimensional models of different objects.
2. Use software's, CAI packages for better imagination.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Engineering Drawing	N. D. Bhatt	Charotar Publishing House
2	Engineering Drawing	P. J. Shaha	S. Chand
3	Engineering Drawing and Graphics	K. Venugopal	New Age International

B) Software/Learning Websites

1. AutoCAD
2. Solid works.

C) Major Equipments/ Instruments with Broad Specifications

Not applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H	H	H								L
CO2	H	H									
CO3	H	M	M	M					L		L
CO4	H	M	M	M					L		
CO5	H	M		H							

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / AE
COURSE : Engineering Mechanics (EMH) **COURSE CODE :** 6108

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

This course helps students in understanding correlation between different engineering and day to day's problems with the knowledge of different laws and principles of mechanics. It helps in solutions to problems related to forces acting on body. It also helps in understanding concepts and applications of Equilibrium, friction, centroid and Kinetics.

It helps in understanding concepts of work, power and energy. Study of simple machines gives idea about input, output, efficiency and friction of machine. Understanding of this course facilitates easy learning of higher level course like strength of materials, Mechanics of structures, Theory of structures, Reinforced concrete structures and Design of steel structures.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the basic concepts of Forces, Equilibrium, Friction, Centre of gravity, Kinetics, Kinematics and simple Machines
2. Understand the basic concepts related to resolution and composition of forces, equilibrium condition and frictional force, centre of gravity, momentum, impulse energy and mechanism of machines.
3. Understand the basic principles of Lami's Theorem, Newton's law of motion, law of conservation of energy, law of machines and laws of friction.

3.0 COURSE OUTCOMES:

The student shall be able to acquire specified learning outcomes in cognitive, psychomotor and affective domain to demonstrate the following course outcomes

1. Describe working of different machines and calculate Velocity Ratio & Efficiency of different Machines.
2. Draw free body diagram of forces acting on a body.
3. Apply laws and principles of mechanics to different practical situations.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamental concepts**	1a. Differentiate Scalar and Vector quantities 1b. Define basic terms relevant to mechanics. 1c. Describe different coordinate systems.	1.1 Mechanics and its relevance to Engineering, Fundamental concepts – scalar quantities, vector quantities. 1.2 Concept of rigid body, Definitions of deformable body, Particle, mass and weight Statics, Dynamics (Kinematics and Kinetics). 1.3 Reference frames of Axes a) Rectangular co – ordinate system b) Polar co-ordinate system. 1.4 Fundamental units, derived units and different systems of units. 1.5 Newton's laws.	04
Unit-II	1.a. Compute M.A,	2.1 Basic concepts – load, effort, input, output,	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Simple Lifting Machines	V.R., Efficiency, Law of Machine for given Machines	mechanical advantage, velocity ratio, efficiency of machine, Law of machine, friction in the machine, ideal machine, reversibility of machine 2.2 Study of machines- simple wheel and axle, differential axle and Wheel, pulley blocks, simple screw jack, worm and worm wheel, winch crab (single & double purchase). 2.3 Numerical examples on above mentioned machines	
Unit-III **Force**	3a. Identify and differentiate different force system 3b. Apply the laws to compute the resultant of given force system	3.1 Concept of force, Coplanar and Non coplanar force system Classification of co planer force system such as collinear, Concurrent, Non concurrent, Parallel, Like Parallel, Unlike Parallel and General force System. 3.2 Law of transmissibility of a force, parallelogram law of forces, resolution and composition of forces, resultant, triangle law of forces, polygon law of forces. 3.3 Resultant of a coplanar concurrent force system (Analytical method) 3.4 Turning effect of force – Moment, Couple, nature of moment, characteristics of couple. 3.5 Varignon's theorem of moments and its application to coplanar parallel and non-concurrent force systems. Resultant of coplanar non concurrent force system (Analytical method)	16
Unit-IV **Equilibrium**	4a. Draw Free Body Diagram 4b. Apply Lami's Theorem 4c. Compute support reactions for given beam	4.1 Concept of Equilibrium, Analytical Conditions of equilibrium, equilibrant. 4.2 Free body diagram (FBD) 4.3 Lami's theorem and its applications 4.4 Reactions at supports of beams - types of supports, types of loads types of beam 4.5 Determination of beam reactions- cantilever beam, simply supported beam and overhanging beam subjected to concentrated loads, uniformly distributed loads and applied moments or couples (Analytical method only)	13
Unit-V **Friction**	5a. Appreciate Friction and its engineering application 5b. Calculate friction forces and coefficient of friction	5.1 Introduction, frictional force 5.2 Laws of friction (static friction only), coefficient of friction, angle of friction, angle of repose. 5.3 Body resting on Horizontal plane, inclined plane and forces acting on the body in any direction	07
Unit-VI **Centroid and Centre of Gravity**	6a. Distinguish between Centroid and Centre of Gravity 6b. Compute	6.1 Definition and Concept of centre of gravity and Centroid. 6.2 Centroid of line segment, centroid of regular areas such as rectangle, square, triangle, circle, semicircle, quarter circle. Problems on	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	Centroid and Centre of Gravity of different plane laminas and solids	location of centroid of composite area consisting of above mentioned regular areas. 6.3 Centre of gravity of regular solids such as cube, rectangular prism, sphere, hemisphere, cylinder, solid cone. Problems on location of centre of gravity of composite solids consisting of above mentioned regular solids.	
Unit-VII **Dynamics**	7a. State equations of motion. 7b. State Newton's Laws, Impulse Momentum equation and Work Energy Principle 7c. To compute work, Power and Energy	7.1 Introduction to dynamics, definition of Kinematics and, types of motion of particle, equations of motion, (No numerical problems on Kinematics) 7.2 Introduction to kinetics, Newton's laws, 7.3 definition of Impulse, momentum, Impulse momentum equation, law of conservation of momentum (No numerical Problems on above) 7.4 Work-power Energy, definitions, units, graphical representation of work, law of conservation of energy, work energy principle, Numerical examples.	08
		TOTAL	**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamental concepts	02	02	--	04
II	Simple Lifting Machines	02	--	06	08
III	Force	02	04	12	18
IV	Equilibrium	02	04	12	18
V	Friction	--	02	08	10
VI	Centroid and Centre of Gravity	--	04	08	12
VII	Dynamics	02	04	04	10
	TOTAL	**10**	**20**	**50**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
	A	Any **Four** of following Exercises	
1	I	Differential axle and wheel	02
2		Simple screw jack	02
3		Worm and worm wheel	02
4		Single gear crab	02
5		Double gear crab	02
6		Two sheaves & three sheaves pulley block	02
7		Differential pulley block	02
8		Geared pulley block	02
	B	Any **Two** of following Exercises	
9	III	Verification of law of polygon of forces	04
10		Verification of law of moments	04
11		Study of forces in the members of jib crane	04
	C	All of the following Exercises	
12	IV	Verification of Lami's theorem	04
13	IV	Beam Reactions	04
14	V	Determination of coefficient of friction	04
15	VI	Centroid of Regular and Irregular Lamina	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Observe and list different activities at home, on Roads and common places where simple machines are used.
2. Observe and list different activities at home, on Roads and common places where principles of Mechanics are involved.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show different simple lifting machines used in workshops and other work places.
2. Show Videos and slides involving application of different Principles of Mechanics.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Theory and problems of Engineering Mechanics- Schaum's outline series Statics and Dynamics SI Edition	E. Nelson, Charles Best & William McLean.	McGraw Hill
2	Engineering Mechanics statics and dynamics	Singer	Harper Collins Publisher, India.
3	Vector mechanics for Engineers (statics and Dynamics)	Ferdinand P. Beer, E Russell Johnson	McGraw Hill
4	Applied Mechanics for polytechnics	P. S. Sawhney & Manikpure	S. Chand & Co. Ltd
5	A text book of Applied Mechanics	Ramamrutham	Dhanpat Rai Pub. Co. (P) Ltd, New Delhi
6	Text Book in Applied Mechanics	M. M. Malhotra, R. Subramanion, P. S. Gahlot	New Age International (P) Ltd. Publishers, New Delhi

B) Software/Learning Websites

www.nptel.com, www.youtube.com, www.howstuffworks.com, www.sciencedirect.com, www.wikipedia.org

C) Major Equipments/ Instruments with Broad Specifications

Force Table, Differential Axle & Wheel, Single and Double Purchase crab, Worm & Worm Wheel, Simple Screw Jack, Pulley Blocks and Reaction of Beam Apparatus.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	H						M			M
CO2	H	H						M			
CO3		H									M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / AE
COURSE : Workshop Practice (WSP) **COURSE CODE** : 6109

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	06	06	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Engineering diploma technician is expected to know conventional workshop practices like welding, Fitting, Drilling, Tapping, Plumbing and hot working processes. The students are required to identify, operate and control various power tools and machines. They should be able to select and use various tools and equipments for various operations and processes like welding, fitting, taping, Plumbing and forging.

The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each shop.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop basic engineering workshop skills.
2. Impart basic know how of various hand tools and their uses in different sections of workshop.
3. Enhance hands on experiences to learn manufacturing, production and advanced manufacturing processes.
4. Develop a skill in dignity of labour, precision at work place, team working and development of right attitude.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Know basic workshop processes.
2. Read and interpret job drawing.
3. Identify, select and use various marking, measuring, holding, striking and Cutting tools & equipments.
4. Operate, control different machines and equipments.
5. Inspect the job for specified dimensions
6. Produce jobs as per specified dimensions.
7. Adopt safety practices while working on the shop floor

4.0 COURSE DETAILS:

There are no separate classes for theory. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Introduction of workshop**	1a. Sketch general workshop layout. 1b. Follow preliminary safety rules in workshop.	1.1 Workshop layout. 1.2 Importance of various shops/ sections of workshop. 1.3 Types of jobs to be done in different sections of workshop. 1.4 General safety rules and work procedures in the workshop.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-II **Fitting Section**	2a. Select appropriate Fitting tools for required application. 2b. Prepare the simple Job as per drawing and specifications by using fitting tools.	2.1 Sketches, specifications and applications of different work holding fitting tools. 2.2 Fitter's bench vice, V-block, Clamps. Sketches, specifications, material, applications and methods of using fitting marking and measuring tools- marking table, surface plate, angle plate, universal scribing block, try-square, scriber, divider, centre punch, letter punch, callipers, digital vernier callipers, height gauge etc. 2.3 Types, sketches, specifications, material, applications and methods of using of fitting cutting tools hacksaw, chisels, twist drill, taps, files, dies. 2.4 Types, sketches, specifications, material, applications and methods of using of fitting finishing tools-files, reamers. 2.5 Sketches, specifications and applications of miscellaneous tools, hammers, spanners, screwdrivers sliding screw wrench. 2.6 Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.etc. 2.7 Preparation of simple and male- female joints. 2.8 Safety precautions at work place in fitting section.
Unit-III **Carpentry Section**	3a. Select appropriate Fitting tools for required application. 3b. Prepare the simple Job as per drawing and specifications by using carpentry tools.	3.1 Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule etc. 3.2 Types of woods and their applications. 3.3 Types of carpentry hardware's and their uses. 3.4 Demonstration of carpentry operations such as marking, sawing, planning, chiselling, grooving, boring, joining etc. 3.5 Preparation of wooden joints. 3.6 Safety precautions.
Unit-IV **Plumbing Section**	4a. Select appropriate pipe fitting tool for the required application. 4b. Prepare the simple job as per specification using pipe fitting tools.	4.1 Types, specification, material and applications of pipes. 4.2 Types, specification, material and applications of pipe fittings. 4.3 Types, specifications, material, applications and demonstration of pipe fitting tools. 4.4 Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling etc. 4.5 Types and application of various spanners such as flat, fix, ring, box, adjustable etc. 4.6 Preparation of pipe fitting jobs. 4.7 Safety precautions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-V **Welding Section**	5a. Select appropriate equipment and consumables for required application. 5b. Prepare the simple jobs as per specification using proper metal joining and cutting method.	5.1 Types, specification, material and applications of arc welding transformers. 5.2 Types, specification, material and applications of arc welding accessories and consumables. 5.3 Demonstration of metal joining operations-arc welding, soldering and brazing. Show effect of current and speed. Also demonstrate various welding positions. 5.4 Demonstrate gas cutting operation. 5.5 Preparation of metal joints. 5.6 Safety precautions.
Unit-VI **Smithy Section**	6a. Select appropriate Smithy tools for the required application. 6b. Prepare the simple jobs as per specification using Smithy tools.	6.1 Introduction to tools and equipments. 6.2 Smithy and Forging operations 6.3 One job of J Hook or I Hook 6.4 (Using round or square bar)
Unit-VII **Tin Smithy**	7a. Select appropriate tin smithy tool for the required application. 7b. Prepare the simple job as per specification using tin smithy tools.	7.1 Concept and conversions of SWG and other gauges in use. 7.2 Use of wire gauge. 7.3 Types of sheet metal joints and applications. 7.4 Types, sketch, specification, material, applications and methods of using tin smithy tools-hammers, stakes, scissors / snips etc. 7.5 Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining. 7.6 Preparation of tin smithy job. 7.7 Safety precautions.

5.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills leading to the achievement of the competency. **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Prepare carpentry and fitting shop layout.	02
2	II	Demonstrate use of different fitting tools –like work holding, marking, measuring, cutting, finishing and miscellaneous. Student will also prepare the report with sketch, specifications and applications of fitting tools demonstrated.	04
3	II	Two jobs Prepare one simple and another male-female type fitting jobs as per given drawings and specifications.	10

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
4	III	Demonstrate use of different carpentry tools. Student will also prepare the report with sketch, specifications and applications of carpentry tools demonstrated.	04
5	III	Prepare one Job From the following allotted to a group of 4 to 6 student depending of volume work involving different joints, Turning and paining operation, surface finishing by emery paper, varnishing and polishing e. g. Electric switch board, pat, Chaurang, Table, Racks etc. OR One simple job involving any one joint like mortise and tendon dovetail bridle half lap etc. One Job per student	12
6	IV	Demonstrate use of different pipe fitting tools. Student will also prepare the report with sketch, specifications and applications of pipe fitting tools demonstrated.	04
7	IV	**Two jobs:** Prepare pipe fitting jobs as per drawings and specifications.	12
8	V	Demonstrate use of different welding transformers and consumables. Also demonstrate arc welding, gas cutting, soldering and brazing operations. Student will also prepare the report with sketch, specifications and applications of welding tools demonstrated.	04
9	V	Prepare jobs using arc welding, gas cutting, spot welding, brazing and soldering process: -.One simple job involving "Butt", "lap" and "T" joint and utility article as per drawing and specifications.	12
10	VI	Demonstrate use of different smithy tools, operations. Student will also prepare the report with sketch, specifications and applications of smithy tools demonstrated.	04
11	VI	**One job:** Prepare one smithy job as per drawing having Job of J Hook or I Hook (Using round or square bar)	12
12	VII	Demonstrate use of different tin smithy tools. Student will also prepare the report with sketch, specifications and applications of tin smithy tools demonstrated.	04
13	VII	**One job:** Prepare one tin smithy job as per drawing having shearing, bending, joining and riveting.	12
		TOTAL	**96**

6.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

Sr. No	Student Activity
1	Prepare student reports as asked in the workshop practical assignment.
2	Visit the nearer timber merchant. Collect the information on types and appearance of wood being sold by them.
3	Visit the nearer plywood merchant. Collect the information on type and thickness being sold by them.
4	Visit nearer fabricator. Collect the information on welding electrodes, transformers and accessories being used by them.
5	Down load movies showing correct practices for fitting, carpentry, Smithy and welding.
6	Assignments on workshop technology tools equipments & processes used in above shops.

NOTES:

1. It is compulsory to follow safety norms while working in the workshop.
2. Preparation Workshop book is compulsory. Record of activities performed by
3. Student in each period is also compulsory and must be duly certified by concerned technical staff and teacher in routine workshop book.
4. Keep your all tools duly resharpened/ready.

5. It is compulsory to submit reports of student activities and workshop book.
6. Students activities are compulsory to perform.
7. Students are to be continuously assessed for competencies achieved.
8. Each student is required to submit the specified term work

7.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show CAI computer software related to workshop technology.
2. CBT Packages.

8.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1.	Mechanical workshop practice.	K.C. John	PHI
2	Workshop Technology-I.	Hazra and Chaudhary Media	promoters & Publisher private limited
3	Workshop Technology-I.	W.A. J. Chapman	Taylor & Francis.
4	Comprehensive Workshop Technology (Manufacturing Processes).	S.K. Garg	Laxmi publications.
5	Workshop practice manual.	K. Venkata Reddy	B.S. Publications.
6	Workshop familiarization.	E. Wilkinson	Pitman engineering craft series.
7	Workshop Technology	B. S. Raghuwanshi	Dhanpat Rai and Sons, New Delhi
8	Workshop Technology	H. S. Bawa	Tata McGraw Hill Publishers, New Delhi
9	I.T.B. Handbook.	-	Engineering industry Training Board.
10	Production Technology Hand Book HMT	-	Tata- McGraw Hill Publisher, New Delhi.

B) Software/Learning Websites

1. http://www.nptel.ac.in
2. http://www.howstuffworks.com
3. http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf
4. http://www.weldingtechnology.org
5. http://www.newagepublishers.com/samplechapter/001469.pdf
6. http://www.youtube.com/watch?v=TeBX6cKKHWY
7. http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related
8. http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu
9. http://www.piehtoolco.com
10. http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/

C) Major Equipments/ Instruments with Broad Specifications

Sr.No.	Name Of Equipments/ Instruments	Qty
	Carpentry Section	
1	Circular saw	1
2	Jig - saw	1
3	Wood Planer	1
4	Drilling Machine Bench Type	1
5	Universal wood working Machine	1
6	Bench Grinder	1
7	Hand Tools Kit	20 Sets
8	Carpentry Bench Vice	20
9	Wood Turning Lathe	5

Sr.No.	Name Of Equipments/ Instruments	Qty
10	Measuring Tools & Gauges	20 Sets
11	Electrician Tool Kit	2
12	Carpentry Work Bench	20
13	Band Saw	1
14	Band saw and Circular Saw Sharpener	1
15	Chain And Chisel Mortising Machine	1
16	Vertical Sander	1
17	Heavy Duty Circular Saw	1
18	Heavy Duty Variable Speed Reciprocating Saw Kit	1
19	Single Speed Impact Drill.	1
20	ANGLE GRINDER.	1
21	Cordless drill (Keyed Chuck)	1
22	Heavy Duty palm grip sander	1
23	Heavy Duty Router	1
	Fitting Shop	
1	Marking Table with scribers	2
2	Surface plate	2
3	Measuring Instruments, Marking Instruments, Fitting Hand Tools	2 Each
4	Tap & die set.	5 Sets
5	Bench Drilling Machine	1
6	Bench Grinder	1
7	Fitting Shop Vice Size- 100/150 mm.	20
8	Electrically operated Hand Drilling Machine (pistol Type)	2
9	Power Hack Saw Machine	1
10	Pedestal Grinder	1
11	Hand Grinder	1
12	Fitter's Work Bench	10
13	Hand Press Double (Pillar Type)	1
14	Arbor Press	1
	Smithy Shop	
1	Hearth with blower	5
2	Anvil	5
3	Leg Vice Size-150mm.	5
4	Swage Black	2
5	Tools and Gauges	20
6	Power Hammer	1
7	Bench Grinder	1
8	Work Bench With vice	2
9	Induction Hardening equipment	1
	Welding Shop	
1	Oil Cooled Arc Welding Transformer Three Phase With Standard Accessories	2
2	Single Phase Air-cooled arc Welding Transformer with Accessories	2
3	Light Duty Spot Welding Machine	1
4	Oxy-Acetylene Gas Welding Set	1
5	Soldering Irons	2
6	Double Ended Pedestal Type Grinder	1
7	Welding accessories	1
8	Electrician Tool Kit	2 Set
9	MIG / Welding Equipment	1
10	T. I. G. Welding set.	1
11	Work Bench With Vice Size- 1800 x 1200 x 750 mm	2
12	Welding Table Size-1200 x 1200 x 750 mm With sliding tray	2
13	DC Arc Welding Transformer Rectifier type 3 Phase	1

Sr.No.	Name Of Equipments/ Instruments	Qty
14	Brazing Equipment and Accessories	1
15	Heavy Duty Angle Grinder.	1
16	Heavy Duty 10 mm. VSR Cordless Drill / Driver Kit.	1
	Sheet Metal & Plumbing Shop	
1	Shearing Machine	1
2	Sheet Bending Machine	1
3	Pipe Bending Devices	1
4	Hand Tools and other Equipment	1
5	Pipe Threading Dies	5
6	Portable Drilling Machine	1
7	Plumber Pipe Vice Size- 50 mm., 12 mm. to 24 mm.	1 & 20
8	Plumber's Tool Kit	1
9	Stoving Oven	1
10	Plumber's Work Bench Size-1800 x 1200 x 750 mm	2
11	Swaging Machine	1
12	Universal sheet Folding Machine	1
13	Double Column Power Press	1
14	Hydraulic Press	1
15	Circle Cutting Machines	1

Note: - Latest Technology & specifications are to consider at the time procurement.

9.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H							M	L	M
CO2		M							M		
CO3	H										
CO4			H	M							M
CO5		M	H	L				H			
CO6			H		M		H	H			
CO7			H			L	H				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Basic Electrical Engineering (BEE) **COURSE CODE** : 6110

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

An Electrical diploma holder has to handle and maintain many types of electrical equipments or machinery. So while completing diploma programme students has to understand working principle, construction, operation & applications of various electrical equipments, machines & instruments, hence the knowledge of basic concepts, rules & laws of electrical engineering is essential for every electrical programme student.

Learning of this course will also help the students to understand the basics of electrical engineering i. e. basic concept in electrical & magnetic circuits.

2.0 COURSE OBJECTIVES:

The student will be able to

1. State and explain various rules, laws related to electric, magnetic circuits & electromagnetic induction.
2. State the definitions and units of various quantities used in electricity, magnetism & electromagnetic induction.
3. Apply the laws of electric circuits to analyze DC electrical circuits.
4. Apply the laws of magnetic circuits to understand the various effects of magnetic circuits.
5. Select and maintain the storage batteries.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Apply the basic rules and laws to solve DC circuit.
2. Identify the applications of effect of electric current
3. Differentiate between Electric circuit and Magnetic circuit
4. Convert Star and delta connection for solving electrical circuits.
5. Select & maintain the storage Batteries
6. Follow safety practices while working on Electrical installations

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals**	1a. State and apply Basic concepts of electricity. 1b. Define resistance and explain the factors affecting resistance 1c. State types of Resistance 1d. Identify the effects of electric current in an appliance	1.1 Concept of electric current 1.2 Concept of Electric potential and potential difference. 1.3 Resistance: Definition, Unit, Laws of resistance, Specific conductivity and resistivity, Effect of temperature on resistance, Temperature coefficient of resistance, Types of resistance & their applications	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		1.4 Effects of electric current - Heating effect, Magnetic effect and Chemical effect. 1.5 Concept of electrical work, power, energy (Their SI units) 1.6 Definitions & terms related to electric circuit and network theorem	
Unit-II **DC Circuits**	2a. State and apply Ohm's law 2b. Solve DC resistive Network using given rules and laws 2c. Identify duality between series and parallel circuit 2d. Carry out star-Delta transformations	2.1 Ohm's law, concept of voltage drop and terminal Voltage 2.2 Resistance in series and parallel- Current division rule, Voltage division rule, Calculations of equivalent resistance of series, parallel and series-parallel circuit. 2.3 Duality between series and parallel circuit 2.4 Kirchhoff's laws: Kirchhoff's current and voltage laws 2.5 Star to Delta and Delta to Star transformations (simple numericals)	14
Unit-III **Magnetic Circuits**	3a. Able to find Polarity of a Electromagnet 3b. Define and explain various terms related to magnetic circuit. 3c. Compare electric and Magnetic circuit. 3d. Solve simple and composite magnetic circuits. 3e. Explain B-H Curve and identify the type of material from it.	3.1 Types of magnets, magnetic materials, magnetic induction, magnetic fields, rules to find polarity of magnet (right hand gripping rule, the end rule, The cork Screw rule) 3.2 Terms related to magnetic circuit – Magnetic flux, permeability (relative & absolute), magneto motive force (MMF), Ampere turns, Reluctance, Permeance. 3.3 Comparison of electric & magnetic circuits 3.4 Derivation stating relation between flux, mmf & reluctance 3.5 Series & parallel magnetic circuits, calculation of total mmf in series and parallel magnetic circuits 3.6 Concept of magnetic leakage, useful flux & magnetic fringing 3.7 Magnetic curve (B-H curve)- magnetic hysteresis loop for hard and soft magnetic materials, Hysteresis loss 3.8 Simple numericals on above topic	12
Unit-IV	4a. State Faradays law of	4.1 Faradays laws of	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Electromagnetic Induction	Electromagnetic Induction 4b. Compare and explain types of induced emf. 4c. Find the direction induced emf. 4d. State and calculate the coefficient of self inductance and mutual inductance 4e. Enlist the types of Inductor 4f. State the factors affecting inductance of a coil. 4g. Describe how energy is stored in a magnetic field.	electromagnetic induction (first law & second law) 4.2 Types of emf: statically & dynamically induced emf 4.3 Direction of induced emf, Fleming's right hand rule, Lenz's law 4.4 Dynamically induced emf 4.5 Statically induced emf- types and magnitude 4.6 Concept of self inductance, mutual inductance, 4.7 Coefficient of self induction, mutual induction, coefficient of coupling 4.8 (Numerical on above topic) 4.9 Factors affecting the inductance of a coil 4.10 Types of inductors & their applications: Air cored, Iron cored and Ferrite core inductors 4.11 Energy stored in magnetic field (no numerals on above topic) 4.12 Introduction of eddy current loss, core loss / iron loss	
Unit-V **Batteries**	5a. Define primary and secondary cell 5b. Describe and compare the types of batteries 5c. Appreciate the electrical characteristics of a battery. 5d. Explain the various charging methods of battery 5e. State the concept of maintenance free battery	5.1 Introduction to Primary & Secondary cell 5.2 Types – Lead acid battery, Nickel iron battery (construction & working). 5.3 Electrical characteristics of batteries, emf, thermal voltage, Amp hour capacity, efficiency, AH efficiency & watt hour efficiency 5.4 Charging methods 5.5 Precautions & maintenance of batteries 5.6 Introduction of maintenance free batteries	08
Unit-VI **Electrical Safety**	6a. Analyse the cause of electrical accidents 6b. State the factors on which severity of shock depends 6c. Exp lain procedure of shock treatment 6d. State precautions to avoid electrical accidents	6.1 Meaning & causes of electrical accidents 6.2 Factors on which severity of shock depends 6.3 Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration 6.4 Precautions to be taken to avoid fire due to electrical reasons	06
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamentals	04	06	02	12
II	DC Circuits	04	06	06	16
III	Magnetic Circuits	04	06	04	14
IV	Electromagnetic Induction	06	08	04	18
V	Batteries	04	04	04	12
VI	Electrical Safety	04	04	--	08
	TOTAL	**26**	**34**	**20**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	To obtain variable voltage from the supply systems (DC supply, single phase & 3 phase AC supply), By using rheostat and auto transformer	04
2	I	Verification of resistance with temperature & Determination of temperature coefficient of copper.	04
3	II	Verification of Ohm's Law	02
4	II	Measurement of current and voltage in series resistive circuit.	02
5	II	Measurement of current and voltage in parallel resistive circuit.	02
6	II	Verification of KCL & KVL for simple circuit.	04
7	III	To obtain BH curve of a magnetic material	04
8	IV	To verify Faraday's first law of electromagnetic induction.	02
9	V	Demonstration of parts of a battery and test a battery for its charged and discharged condition	04
10	VI	Demonstration of fire extinguisher and artificial respiration through video	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Observe and list out various electrical appliances and name the effect of electric current used in it.
2. Prepare an Electromagnet using 12 V DC supply
3. Name the type of Battery used in a vehicle and residential inverter. Write the specifications of the same.
4. Collect literature of Safety practices followed in an industry.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show Videos of Electrical accidents for case study.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	text book of electrical technology Volume- I	B.L. Theraja A.K. Theraja	S. Chand & Co.
2	Basic Electrical Engineering A.	V.N. Mittal	Tata McGraw Hill
3	Electrical Technology	Edward Hughes	E.L.B.S.
4	Fundamentals of Electrical Engineering	M.N. Mittal	Everest Publishing House

B) Software/Learning Websites

1. www.narosa.com
2. www.howstuffworks.com

C) Major Equipments/ Instruments with Broad Specifications

1. Ammeter
2. Voltmeter
3. Rheostat
4. Lamp Bank
5. Galvanometer

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	M	H	L								
CO2	M	H			L						
CO3		H	L								
CO4		H		H							
CO5					H					L	
CO6		L			H	H					

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Fundamentals of Electronics (FEX) **COURSE CODE :** 6111

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100		--	50	150
					Min.	32	--	40		--	20	--

1.0 RATIONALE:

This course deals with impart knowledge fundamental electronic devices used in all electronic circuits. Fundamental knowledge of electronic circuit and its use in control system has become essential for the technician. Fundamentals of Electronics are a core course which will help to students in understanding Analog and Digital Electronics, Power Electronics. Students will develop proficiency in construction, working principle, characteristics and applications of electronic devices. On completion of learning of this course, the student will have an insight to identify, classify different electronic devices assemble and troubleshoot simple electronic circuits. Hence, this preliminary course will assist student in maintenance and operation of electrical systems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know various semiconductor devices and their applications.
2. Understand principle and terminology of semiconductor devices.
3. Understand the use of semiconductor devices in electronic circuits.
4. Analyse the characteristics of Semiconductor and Thyristor family devices
5. Describe the working of basic circuits such as rectifiers, filters, Amplifiers, Oscillators and Regulators.
6. Build and test simple electronics circuits.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify the different semiconductor devices.
2. Understand the principle of working of semiconductor devices.
3. Assemble Simple electronic circuit
4. Read the datasheets of different Semiconductor devices.
5. Troubleshoot the fault in given circuit.
6. Identify faulty component in given circuit.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Semiconductor Diodes**	1a. Categorize different semiconductor Diodes. 1b. Draw circuit and explain operation of P-N Junction diode in forward and reverse biased Condition. 1c. Draw & Explain V-I	1.1 **P-N Junction Diode**: • Introduction to P-N Junction, Formation to P-N Junction, Formation of depletion Layer in P-N Junction, Barrier Voltage. • Symbol, Construction, Working Principle of P-N Junction Diode. • Biasing of the P-N Junction diode: Forward Bias, Reverse Bias. V-I	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	Characteristics of P-N Junction Diode. 1d. List the applications and specifications of P-N Junction diode. 1e. Draw circuit and explain operation of Zener diode in forward and reverse biased Condition. 1f. Draw & Explain V-I Characteristics of Zener diode. 1g. List the applications and specifications of Zener diode. 1h. Describe the Construction and Applications of LED. 1i. Describe the Construction and Applications of Photodiode. 1j. Describe the Construction and Applications of Optocoupler.	characteristics (Forward and Reverse characteristics) of P-N Junction Diode. • Static and Dynamic resistance of a diode. • Diode specifications: Forward Voltage drop, Maximum Forward current, Reverse Saturation Current, Power dissipation, Peak Inverse voltage. • Applications of P-N Junction Diode. 1.2 **Zener Diode:** • Symbol, Operating Principle, V-I Characteristics (Forward And Reverse characteristics) • Zener Diode specifications: Zener Voltage, Maximum Reverse current, Power Dissipation. • Applications of Zener Diode. 1.3 **Light Emitting diode (LED)** : Symbol, Construction and Operating Principle, V-I Characteristics, applications. 1.4 **Photodiode** : Symbol, Construction and Operating Principle, V-I Characteristics, applications. 1.5 **Optocoupler:** Construction & applications.	
Unit-II **Rectifier and filters**	2a. Define rectifier and State its necessity. 2b. Categorize and compare different Rectifiers. 2c. Draw circuit diagram and explain operation of Half and full wave rectifiers with input and output waveform 2d. Define various terms related to rectifiers like Ripple Factor, Efficiency, PIV and TUF. 2e. Define filter and State its necessity. 2f. Categorize and compare different Filters. 2g. Draw circuit diagram and explain operation L, C, LC and CLC	2.1 **Rectifier**: • Definition, Need for Rectification, Types of Rectifiers- Half wave Rectifier, Full Wave Rectifier (Centre Tapped and Bridge) • Circuit diagram, Operation and input and output Waveforms. Definitions : Average dc voltage, Average dc current, Ripple Factor, Efficiency, PIV, Ripple frequency, Transformer Utilization factor (TUF) (No derivations) • Comparison of Rectifiers 2.2 **Filter**: • Definition, Necessity of Filters, Types of Filters – L, C, LC and CLC. Circuit Diagram, working with Input and Output Waveform of L, C, LC and CLC Filters. • Comparison of Filters.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	filters with Input-Output Waveforms.		
Unit-III **Transistors**	3a. Compare Unipolar and bipolar Junction Transistors. 3b. Classify Transistors. 3c. Explain working principle of NPN and PNP transistor. 3d. Draw the circuit diagram of CE, CB, CC transistor Configurations. 3e. Draw and explain Input and output Characteristics of CE Configuration. 3f. Identify and label different regions of Output characteristics of transistor in CE Configuration. 3g. State the need of Transistor biasing. 3h. List the Types of Unipolar Transistor. 3i. Draw construction and Characteristics of N channel FET. 3j. Draw construction and Characteristics of UJT. 3k. List the applications of BJT, FET and UJT. 3l. Compare BJT and FET.	3.1 Transistor: Definition and Types 3.2 Introduction to Unipolar and Bipolar junction Transistors 3.3 **Bipolar junction Transistors**: Definition, Types (PNP, NPN) Symbol, Working Principle of NPN and PNP transistor. • Types of Transistor Configurations: CE, CB, CC (Only circuit Diagrams), Characteristics of CE configuration (Input and Output Characteristics) Identification of Cut off, Active and Saturation Region, Input resistance, Output resistance, Current gain factor (β). • Transistor Biasing: Need of biasing, DC load line and Q-point. Types of biasing – Voltage divider bias method. • Specifications and applications of Transistor.(BJT) • Transistor as a switch- circuit Diagram, Operation. 3.4 **Unipolar Transistors**: Types: (FET and MOSFET) and UJT • Field Effect Transistor (FET): Types of FET: N Channel and P channel, Symbol, Construction and working principle. • Characteristics of FET: Drain and Transfer Characteristics. • Applications of FET. • Types of MOSFET: Symbol, Construction and working principle. • Unijunction Transistor (UJT): Symbol, Construction and working principle, Characteristics of UJT. • Specifications and applications of UJT. • UJT relaxation oscillator 3.5 Comparison of FET and BJT.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-IV **BJT Amplifiers and Oscillators**	4a. Define amplifier and oscillator. 4b. Draw circuit diagram of single stage CE amplifier and explain its working. 4c. Define various terms Bandwidth, Current gain, Voltage gain and Power gain 4d. State necessity of multistage amplifier. 4e. List the types of Coupling used in multistage amplifier 4f. Draw circuit diagram of two stages RC coupled CE amplifier and state function of each component. 4g. List the applications of each types of multistage amplifier. 4h. State necessity of Oscillators 4i. Draw circuit diagram of RC, LC and Crystal Oscillator and explain its working.	4.1 **Amplifier**: Definition, Classifications of an Amplifier. • Single Stage CE amplifier: Circuit Diagram, function of components, working and frequency response of an amplifier. 4.2 Definition of Bandwidth, Current gain, Voltage Gain and Power Gain. 4.3 Multistage amplifiers: Need for multistage amplifier. 4.4 Types of Coupling: RC coupling, Transformer coupling, Direct Coupling. Types of multistage amplifier: RC coupled, Transformer coupled, Direct Coupled Amplifier. 4.5 Two stage RC Coupled CE amplifier Circuit Diagram, Frequency response and Function of each component Application of each type of multistage Amplifier. 4.6 **Oscillator**: Definition, Need for oscillator. 4.7 Types of oscillator: RC, LC Oscillator and Crystal Oscillator. Circuit Diagram, Operating principle and application.	12
Unit-V **Regulated Power Supply**	5a. Define Voltage Regulator. 5b. State Need of Voltage regulator. 5c. Draw block diagram of Regulated power Supply and explain it. 5d. Categorize different Voltage regulators. 5e. Describe circuit Diagram and explain operation of different Voltage regulator.	5.1 Need of Regulated Power Supply 5.2 Block diagram and operation of Regulated power supply. 5.3 Voltage regulators : Definition, Need, Types of Voltage regulator, Concept of line and load Regulation. 5.4 Zener voltage regulator Circuit diagram and operation. 5.5 Transistorized series and shunt voltage regulator Circuit diagram and operation. 5.6 IC voltage regulator Circuit Diagram and working of 78XX and 79XX voltage regulator.	10
Unit-VI **Introduction to Thyristor family Devices.**	6a. Categorize different power electronic devices. 6b. Describe construction and operation of SCR, DIAC and TRIAC. 6c. List the applications of SCR, DIAC, TRIAC,	6.1 Introduction and Meaning of Power Electronic Devices, classification of thyristor family devices. 6.2 Symbol, V-I Characteristics and Applications of SCR, TRIAC, DIAC, PUT, SUS, SBS, SCS, LASCR and LASCS.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	SUS, SBS, SCS, LASCR and LASCS. 6d. Compare different power devices.	6.3 Constructional diagram, Operating principle and V-I Characteristics of SCR, DIAC, TRIAC.	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and Above Level	Total Marks
I	Semiconductor diodes	06	04	02	12
II	Rectifier and Filters	04	04	04	12
III	Transistors	06	06	04	16
IV	BJT Amplifier and Oscillators	04	06	06	16
V	Regulated Power Supply	04	04	04	12
VI	Introduction to Thyristor family Devices	04	04	04	12
	TOTAL	**28**	**28**	**24**	**80**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Demonstration for identification and use of different equipments i.e. CRO, Function generator, Multimeter and Power Supply.	02
2	I	Plot V-I characteristics of PN-Junction Diode	02
3	I	Plot forward and reverse characteristics of Zener Diode.	02
4	I	Plot V-I characteristics of LED	02
5	II	Observe the input and output waveforms of Half Wave Rectifier on CRO without filter.	02
6	II	Observe the input and output waveforms of Half Wave Rectifier on CRO with filter.	02
7	II	Observe the input and output waveforms of Full Wave Rectifier on CRO with and without filter.	02
8	III	Plot Input and output characteristics of transistor in CE mode.	02
9	III	Plot V-I characteristics of FET.	02
10	III	Plot V-I characteristics of UJT.	02
11	III	Test and verify Transistor as a Switch.	02

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
12	IV	Plot Frequency response of single stage RC coupled CE amplifier and calculate Bandwidth.	02
13	IV	Observe the output waveforms of Hartley Oscillator on CRO and calculate frequency oscillation.	02
14	V	Test and verify Zener Diode as a Voltage Regulator	02
15	VI	Plot VI characteristics of SCR.	02
16	VI	Plot VI characteristics of DIAC.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Download data sheets of Diodes (IN4001-IN4007), Transistors (BC546 BC547 BC548) and Voltage regulator ICs like 78xx, 79xx.
2. Market survey to collect data about Prices of different electronic Components, devices and equipments used in an Electronics laboratory.
3. Collect specifications of Regulated power supply used in your laboratory.
4. Collect data sheets FET, MOSFET and UJT.
5. Collect specifications of Thyristor family devices

a. (SCR, TRIAC, DIAC, PUT, SUS, SBS, SCS, LASCR and LASCS.)

6. Assemble simple electronic circuit on breadboard
7. Mini project based on simple Electronic Circuit.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1. Show animation videos to demonstrate the working principles and constructional features of different types of semiconductor devices and circuits.
2. Arrange expert lecture of an Industry Person or Trained Faculties in the area of core electronics.
3. Arrange an Industrial visit to PCB Making or assembling industry.
4. Arrange faulty electronic circuit and provide to students for repairing.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Principles of Electronics	V.K. Mehta Rohit Mehta	S. Chand and company Ltd, New Delhi.1st Edition 1980, ISBN:81-219-2450-2
2	A textbook of Applied Electronics	R.S. Sedha	S. Chand and company Ltd, New Delhi.1st Edition 1990, ISBN:81-219-2783-8
3	Basic Electronics and Linear Circuits	N.N. Bhargava, DC Kulshreshtha S.C. Gupta	Tata McGraw-Hill Education Pvt. Ltd. New Delhi, ISBN :0- 07-451965-4
4	Basic Electronics	V.K. Mehta	S. Chand and company Ltd, New Delhi.1st Edition, ISBN:81-219-2450-4
5	Power Electronics	M D Singh K B Khanchandani	Tata McGraw-Hill Education Pvt. Ltd. New Delhi.2nd Edition, ISBN:13-978-0-07-058389-4
6	Thyristor and its Applications	Ram Murty	PHI Learning, New Delhi.

B) Software/Learning Websites

1. www.alldatasheet.com
2. http://powersimtech.com.
3. http://www.electronicstheory.com
4. http://www.nptel.com
5. http://www.electronictutorial.com
6. http://www.allaboutcircuit.com

C) Major Equipments/ Instruments with Broad Specifications

1 DC Regulated dual Power supply.

1. O/P voltage – 0 to 30 Volt, 2A in 3 range in both channel
2. Display – 3 ½ digit,
3. Load regulation – 0.5 V % + 10mV, no load full load for each channel
4. Line regulation – 0.05 % + 15 mV for +/-, Variation around 230 volt
5. O/P imp – 15 milliohms,
6. Ripple – less than 1mv rms.
7. I/P supply – 230 V +/- 10 % 50 Hz.
8. Both channel tracking mode

2 Function generator

1. Out Put wave form – Sine, Triangle, Square.
2. Frequency range – 0.1 Hz to 3 MHz
3. Amplitude Range – 30mv to 30 Volt P- P
4. O/P impedance – 50 V
5. offset capability
6. Display – 4 digit LED/ LCD

3 CRO

1. Dual Channel, 4 Trace CRT / TFT based
2. Bandwidth 20 MHz/30 MHz
3. X10 magnification 20 ns max sweep rate
4. Alternate triggering
5. Component tester
6. Digital Readout
7. USB interface
8. (Any other Oscilloscope with additional features are also suitable)

4 Experimental kits:

1. Experimental kit- V-I Characteristics of PN junction diode
2. Experimental kit- V-I Characteristics of Zener diode
3. Experimental kit- V-I Characteristics of Light Emitting Diode
4. Experimental kit- Half Wave Rectifier and Full Wave Rectifier
5. Experimental kit -Input and output Characteristics of CE mode
6. Experimental kit -Single stage RC coupled amplifier
7. Experimental kit - Hartley Oscillator
8. Experimental kit- Zener Diode as a Voltage Regulator
9. Experimental kit –V-I characteristics of SCR
10. Experimental kit –V-I characteristics of DIAC

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**B**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	L	H		M							
CO2					H		M				L
CO3				H							
CO4			M	L							H
CO5	H							L			
CO6	L			H							

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Basic Mechanical Engineering (BME) **COURSE CODE** : 6112

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	02	05	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Electrical technician when they work in industries, mainly they have to tackle the maintenance problems. The Knowledge of mechanical equipment, machinery, drives is essential for electrical engineer to deal the problem effectively, hence this course is included in the electrical Engineering program.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know the function of different mechanical equipment along with their location.
2. Understand working of high pressure boilers and steam turbine and thermal power plant.
3. Know the operation and control of fuel and steam supply.
4. Enlist sources of waste heat from boiler, IC engine.
5. Describe internal combustion engine.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Recognize troubles in machine elements.
2. Perform the simple tasks related to mechanical engineering so as to reduce the dependency on mechanical engineers and to achieve the reliability and quality of own branch's tasks.
3. Selection of tools and equipment as per task requirement
4. Operate the pumps and IC engine

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Sources of Energy**	1a. Explain the sources of conventional and nonconventional sources of energy 1b. Differentiate between conventional and nonconventional sources of energy	1.1 Conventional energy resources like thermal power plant, Nuclear power plant, Gas power plant and hydraulic power plant 1.2 Non-conventional energy resources: Solar, wind, tidal, geothermal, biogas and Biomass	08
Unit-II **Boilers, Steam Turbines, Steam Engine**	2a. Calculate the properties of two phase system by using steam table 2b. Explain construction & working of boilers and turbines 2c. Identify the heat losses & malfunctioning of	2.1 Construction and working of critical and super critical boilers. 2.2 Boiler efficiency 2.3 Boiler Act (for remedial measure). 2.4 Classification of turbines. 2.5 Impulse and reaction turbine. 2.6 Power developed by turbine. 2.7 Different power losses in turbine.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	boilers		
Unit-III **I.C. Engines**	3a. Identify the trouble shooting of IC engines 3b. Calculate performance of engine 3c. Identify the malfunctioning Causes	3.1 Classification of I.C. engines. 3.2 Testing and performance of I. C. engines to calculate Break power, Indicated power, Frictional power 3.3 Fault finding and remedial action. 3.4 Starting motor of I.C. engine.	08
Unit-IV **Air Compressor**	4.a. Know the working principles of air compressor 4.b. Identify Methods of energy saving 4.c. Identify the fault & suggest remedies	4.1 Introduction 4.2 Definition: Compression ratio, Compressor capacity, free air, Deliver, swept volume. 4.3 Reciprocating and rotary air compressor, their working and 4.4 Construction. 4.5 Methods of energy saving in compressor. 4.6 Fault finding and remedial action.	08
Unit-V **Pumps**	5a. Selection of pumps for various applications 5b. Know the construction & working of pumps	5.1 Classification of pumps. 5.2 Type of pumps and their working. 5.3 Power required running the pump. 5.4 Fault finding and remedial action.	06
Unit-VI **Refrigeration and Air Conditioning**	6a. Know the construction & working of RAC equipments 6b. Differentiate between refrigeration and air-conditioning 6c. Differentiate between summer, winter and year-round air-conditioning	6.1 Introduction, 6.2 Refrigerating effect, Unit of refrigeration and C. O. P. 6.3 Basic components and working of vapor compression Refrigeration system, 6.4 Study of Domestic refrigerator and water cooler, 6.5 Working of Solenoid and thermostatic switch and electrical safety, 6.6 Introduction to air conditioning 6.7 Study of summer, winter and year round air conditioning system. 6.8 Study of window air-conditioning and water cooler	10
TOTAL			**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (Practical)

Unit No.	Unit Title		Distribution of Theory Marks			
			R Level	U Level	A and above Levels	Total Marks
I	Unit-I	Sources of energy	08	04	02	14
II	Unit-II	Boilers, Steam turbines, Steam engine	08	04	04	16
III	Unit-III	I.C. Engines	08	04	04	16
IV	Unit-IV	Air Compressor	04	04	04	12
V	Unit-V	Pumps	06	02	02	10
VI	Unit-VI	Refrigeration and air conditioning	08	02	02	12
	TOTAL		**42**	**20**	**18**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Trial on solar water heater	04
2	II	Study boiler, boiler mountings and boiler accessories.	04
3	III	Perform and study the effect of variation of load on fuel consumption of an I.C. engines (On petrol engine). Also locate the faults in a given petrol engine and suggest remedial measures.	04
4	III	Perform and study the effect of variation of load on fuel consumption of an I.C. engines (On diesel engine). Also locate the faults in a given diesel engine and suggest remedial measures.	04
5	II	Trial on water-turbine. Perform test on Air compressor. Perform test on centrifugal pump. Also find fault and remedies for centrifugal pump. 02	04
6	I	Demonstration and analysis of solar photovoltaic panel operated tube lights; lamps.	04
7	VI	Trial on vapor compression refrigeration system	04
8	--	Observe constructional details and study different power transmission elements used in Sugar Cane Juice machine, Lathe machine.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Student will visit the industry and write a report on visit to Sugar factory/steam power plant consisting of (a) Working of boiler (b) Working of turbine (c) Foundation of boiler.
2. Student will visit industry and write a report on visit to Sugar factory/steam power plant to observe (a) Operation of condenser (b) Operation of cooling tower.
3. Student will observe the fuel supply system of any bike and will also observe the working of engine.
4. Student will also identify the type and specification of engine used for bike.
5. Prepare the list of mechanical items surrounding to you.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Domkundwar V. M.	A Course In Thermal Engineering	Dhanpat Rai & Co
2	R. K. Bansal	Fluid Mechanics & Hydraulic Machine	Laxmi Publication
3	T. S. Rajan	Basic Mechanical Engineering.	New Age International
4	Dr. Kripal Singh	Automobile Engineering	Standard Publishers Distributers
5	R. S. Khurmi	A Text Book Of Thermal Engineering	S Chand & Co. Ltd
6	C. M. Agrwal K	A text Book Of Thermal Engineering	Wiley Precise Text Boo

B) Software/Learning Websites

1. www.mt-online.com
2. http://www.youtube.com/watch?v=1cFu2bkZ7Vw&feature=related (IC engine)
3. http://www.youtube.com/watch?v=pCg1Ih_oVSA (pump)
4. http://www.youtube.com/watch?v=V3aPHmZ97yM&feature=related (pump)
5. http://www.youtube.com/watch?v=FENCiA-EfaA&feature=related (impeller)
6. http://www.youtube.com/watch?v=TBdUcGYo7XA (gas turbine)
7. http://www.youtube.com/watch?v=HzQPNpP55xQ (turbines
8. http://www.youtube.com/watch?v=e_CcrgKLyzc (coal power plant
9. http://www.youtube.com/watch?v=8GSUgwombdE&feature=related (boiler)
10. http://www.youtube.com/watch?v=A3ormYVZMXE (hy.lift)
11. http://www.youtube.com/watch?v=FP05rYRI9JU&feature=related (hy. pump)
12. http://homepages.cae.wisc.edu
13. http://www.youtube.com/watch?v=E6_jw841vKE&feature=related (air compressor)
14. http://www.youtube.com/watch?v=twM-GLUYQ-o&feature=related (belt drive)
15. http://www.youtube.com/watch?feature=endscreen&v=gjUwJ1CJVq4&NR=1 (belt drive)

C) Major Equipments/ Instruments with Broad Specifications

1. Various power transmission devices.
2. Workshop based machine tools-Hacksaw, Lathe, Drill and Milling.
3. Boiler/ Working model of boiler.
4. Petrol engine test rig.
5. Diesel engine test rig.
6. Air compressor test rig.
7. Water turbine test rig
8. Centrifugal pump test rig.
9. Solar water heater test rig

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		M	H		M	M			L		M
CO2	M		H	M	M		L	H	M	L	
CO3	M		M	H		H					
CO4		M	H								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / PS / EE
COURSE : Computer Aided Graphics (CAG) **COURSE CODE** : 6201

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

This course provides the basic knowledge of the Computer Aided Drafting for Civil / Plastic / Electrical Engineering.

This course gives basic foundation knowledge for advance computer based software. Today the manufacturing industries needs the computer oriented man power for their global needs and to cope up the fast changing technology. Moreover, the conventional method of drafting of the objects has been replaced by computer-based drafting. Therefore this course is introduced in the present curriculum.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the importance of Computer Aided Drafting (CAD).
2. Use basic CAD command to develop 2D drawings.
3. Use CAD commands for edit/modification of existing drawings as per needs and suggestions.
4. Print the drawing.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. State the applications, advantages and features of CAD.
2. Execute CAD commands.
3. Prepare a simple drawing file using basic draw commands.
4. Apply basic CAD command to develop 2D drawings related to discipline.
5. Apply CAD commands for edit/modification of existing drawings.

4.0 COURSE DETAILS:

There are no separate classes for theory as given below. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Introduction to Computer Aided Drawing**	1a. State the applications and advantages of CAD 1b. State the features of CAD as drafting package 1c. State the hardware requirements to run CAD	1.1 Advantages of CAD 1.2 Applications of CAD, Components of CAD system
Unit-II **Basic menus in CAG**	2a. Identify component of the drawing screen. 2b. Apply the methods of selecting/entering commands to start new drawing	2.1 Opening of Drawing, commanding CAG, Command windows, text window, AutoCAD Command, 2.2 Entering commands at command prompt, Pull down Menus, Screen menus, Entering command from dialog

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	2c. Execute CAD commands by selecting from menus, tool bars and entering Commands on command line. 2d. Set the limits of the drawing to get the needed working area. 2e. Apply the 'setting commands' Grid, Snap, & Ortho Commands.	box. 2.3 Using transparent command, Repeating command and, System variables, 2.4 Co-ordinates system: WCS, UCS, UCSICON. UNITS, Setting of drawing screen using limits and zoom all command, Display of co-ordinates on screen, 2.5 Entering the Co-ordinates: Cartesian coordinate, polar coordinate, scale factor, limits setting, Grid setting, snap setting, Creating, saving and exiting / end drawing files.
Unit-III **Drawing Display Commands**	3a. Apply display commands and commands to view drawing. 3b. Apply 'view commands'	3.1 Zoom in and zoom out command & dynamic zoom, Size of windows, View command, PAN command, Redraw – Regen command, Blipmode & Redraw command, Viewers' command, Hide command, View ports command, Plan command, fill command, Drag Mode command
Unit-IV **Drawing Commands**	4a. Prepare a simple drawing file using basic commands 4b. Apply 'Draw commands'.	4.1 Point, Line, Circle, Arc, Ellipse, polygon, Pline, Donut, Trace. 4.2 Osnap Modes, Aperture command, Text and dtext command, style command, Shape command.
Unit-V **Edit Commands**	5a. Explain the applications of Edit commands 5b. Modify existing drawing. 5c. Apply 'modify commands.	5.1 Select, Erase, oops, move, copy, Array, Explode, List, Rotate, Break, trim, extend, Fillet, Chamfer, Divide, Offset, Change, Chprop, Pedit, Area, Measure, Mirror, Dlst, Stretch, U, Undo.
Unit-VI **Dimensioning Commands.**	6a. Dimension the given figures.	6.1 Linear dimensioning concept. 6.2 Dim: Continue, Baseline, Angular, Diameter 6.3 Dimension editing commands - New text, Tedit, Trotate, Hometext, Update, Dimension Utility Commands.
(Only For PS) Unit-VII **3-D Commands**	7a. Apply 3D commands to given drawing.	7.1 Extrude, Change properties, Region Hide, Union, Pan, Hidden, 3-D mesh, Subtract, Revolve, Shade, 3D view (SW, SE, NE, NW, TOP, Bottom, left, right, front, back) View ports (1, 2, 3, 4 view ports), 3D Orbit.

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Laboratory Work:

A) For Civil Engineering Programme only

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I, II, III	Study and use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	IV	Draw 2mm, 4 mm and 6mm text used for civil engineering drawing	04
3	IV, V	Draw five symbols each of following a) Civil Engineering Materials b) Doors and Windows c) Water supply and Sanitary Fittings d) Electrification	08
4	I to VI	Draw Plan, Elevation and Side view for steps or any civil engineering object	04
5	I to VI	Draw Line plan for a small residential / public building	08
6	I to VI	Draw Section of load bearing wall up to parapet for a single storeyed building.	08
7	I to VI	Draw Plan and section of an isolated RCC column footing.	04
8	I to VI	Draw Plans for any four types of stairs used in residential building	04
9	I to VI	Draw Detailed Plan and Elevation of single storeyed flat roofed small residential building	16
		TOTAL	**64**

B) For Electrical Engineering Programme only

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I, II, III	Study and use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	IV	Draw 2mm, 4 mm and 6mm text used for Electrical engineering drawing	04
3	IV, V	Draw electrical symbols for various electrical devices	08
4	I to VI	Draw circuit diagram for godown and staircase wiring	04
5	I to VI	Draw control and power circuit diagram for DOL starter	08
6	I to VI	Draw front panel of an electronic digital multimeter	08
7	I to VI	Draw transmission tower of single circuit or double circuit	04
8	I to VI	Draw electrical installation plan for small residential unit	04
9	I to VI	Draw single line diagram and wiring diagram of three phase induction motor connected to supply with star delta starter.	16
		TOTAL	**64**

For Plastic Engineering Programme only

Sr. No.	Unit No.	Name of Laboratory work	Hours
1	I to VI	Use of basic 2D commands for display, drawing, editing, modifying and dimensioning.	08
2	VII	Use of 3D commands such as Extrude, Change properties, Region Hide, Union, Pan, Hidden, 3-D mesh, Subtract, Revolve, Shade, 3D views etc.	12
3	I to VII	Draw standard plates for injection mould.	04
4	I to VII	Draw sprue bush, guide pin, ejector pin, stopper pin and ejector rod for injection mould.	04
5	I to VII	Draw different types of gate in injection mould with section.	04
6	I to VII	Draw locating ring and guide pillar with dimensions and section.	08
7	I to VII	Draw different plastic products with dimensions by using 3D commands.	08
6	I to VII	Draw balanced runner layout for 8, 16, 32 and 64 cavities with dimensions.	08
7	I to VII	Draw single cavity two plate injection mould with section and dimensions.	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

A) FOR CIVIL ENGINEERING STUDENTS

1. Visit to architect/civil engineering firm for understating the CAD and its applications and study of typical drawings prepared by AutoCAD
2. Collect different types of civil drawings in hard copy from architects, builders and practicing engineers prepared using CAD software

B) FOR ELECTRICAL ENGINEERING STUDENTS

1. Contact a design engineer, understand the use of computer aided drawings in profession
2. Visit to an industrial workshop collect various electrical drawings.

C) FOR PLASTIC ENGINEERING STUDENTS

1. Visit to TECHNOCAD/ACCESSCAD/MG DESIGNERS AND ENGINEERS or any other CAD institutes or CAD/CAM centre.
2. Collect and practice mould / die drawings from industries.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Lecture Method, Use of teaching aids, Industrial Visits, Demonstrations and Expert Lectures.

9.0 LEARNING RESOURCES

A) Books

Sr.No.	Title of Book	Author	Publication
1	Auto Cad 2005	George, Omura B. Robert Callori	BPB Publisher
2	Auto Cad 2005 Instant Reference	George Omura B. Robert Callori	BPB Publications
3	Auto Cad 2007 Bible	Famkline	Wiley
4	Auto Cad 2007 L T	Fred·Bery	Wiley
5	Working With AutoCAD	Ajit Singh	Tata McGraw Hills

B) Software/Learning Websites

AutoCAD

1. http://www.ferris.edu/htmls/academics/course.offerings/hillm/MYWEB7/index.html
2. http://mould-technology.blogspot.in/search/label/Mold%20Construction
3. http://webhotel2.tut.fi/projects/caeds/tekstit/mould/mould_structure.pdf
4. http://mould-technology.blogspot.in/2008/02/basic-functions-of-mold-base-parts.html

C) Major Equipments/ Instruments with Broad Specifications

1. Computers
2. LCD Projectors
3. Printers

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H	M									
CO2	H	M	H	H	M						M
CO3	H	H	H	H	M	L	M	M	M		M
CO4	H	M	H	H	M						M
CO5	H	M	H	H	M						M

H: High Relationship, M: Moderate Relationship, L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Analog and Digital Electronics (ADE) **COURSE CODE :**6228

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

An electrical engineer working in an industry is required to make use of different integrated circuits in analog electronics and digital techniques for various industrial applications. The engineers working in these areas are faced with the need to understand the theoretical a practical design of different analog and digital circuits. This course acquaints the students with general analog and digital principles, design methodologies using practical devices and application. It focuses learning about signal conditioning, signal generation, instrumentation, facts, concepts, principles and procedure of digital techniques and semiconductor memories.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Define parameters and know applications of integrated circuits.
2. Developing new ideas for circuits used in instrumentation and communication industries using linear integrated circuit components like operational amplifier (op-amp), sample and hold circuit.
3. Know various number system and codes.
4. Understand combinational and sequential logic circuits
5. Understand logic families, data converters and semiconductor memories.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify operational amplifier parameters and different circuits.
2. Design and implement basic circuits using operational amplifier.
3. Assemble, implement & test various applications of operational amplifier.
4. Convert a number from one number system to another.
5. Implement combinational and sequential circuits.
6. Explain different data converters and memories.
7. Design simple applications using digital circuits.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Operational Amplifiers**	1a. Draw labeled block diagram of operational amplifier. 1b. Specify and define different parameters of operational amplifier. Interpret ideal transfer characteristics and	1.1 Block diagram of operational amplifier, function of all stages in operational amplifier block diagram, balanced, unbalanced differential amplifier. 1.2 Importance of operational amplifier, 741 IC, pin diagram, pin function. circuit symbols and terminals, equivalent circuit 1.3 Parameters of operational amplifier-	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	electrical characteristics of operational amplifier for the given circuit	definitions of parameters. 1.4 Ideal operational amplifier – Electrical characteristics, ideal voltage transfer curve	
Unit-II **Operational Amplifier Basic Circuits**	2a. Differentiate between open loop and closed loop configuration. 2b. Identify inverting and noninverting configuration 2c. Construct integrator and differentiator.	2.1 Virtual ground concept. 2.2 Open loop configuration & closed loop configuration – inverting, Non-inverting amplifier. Differential amplifier, voltage follower. 2.3 Adder and sub tractor. 2.4 Practical integrator. 2.5 Practical differentiator 2.6 Numerical based on designing of above circuits.	12
Unit-III **Applications Of Op-amp**	3a. Draw and Explain instrumentation amplifier, comparators and voltage regulator. 3b. Draw pin diagram and explain pin functions of IC 723 3c. Assemble and test different application circuit using operational amplifier. 3d. Distinguish between the different types of filters or classify filters	3.1 Comparators – basic concept of comparator, zero crossing detector, Schmitt trigger, peak- to-peak detector, comparator IC LM710 3.2 Voltage regulator IC LM 723- pin diagram, pin functions. 3.3 Necessity and requirements of instrumentation amplifier, instrumentation amplifier- using three operational amplifier, 3.4 Sample and Hold circuit 3.5 Active filters, types 3.6 Concept of passive and active filters and Merits and demerits of active filters over passive filters 3.7 Ideal and actual characteristics of filters, definition of the terms: - cut off frequency, pass band, stop band, centre frequency, roll off rate, low pass filter and high pass filter using operational amplifier.	12
Unit-IV **Number Systems**	4a. List different number systems. 4b. Convert one number systems to another. 4c. Perform binary arithmetic. 4d. Explain different codes and BCD addition and subtraction.	4.1 Introduction to digital systems 4.2 Numbers Systems: Binary, Decimal, Octal, Hexadecimal. 4.3 Conversion of one number system to another.(binary to decimal, decimal to binary, hexadecimal to binary, binary to hexadecimal, octal to binary, binary to octal) 4.4 Binary Addition, Binary Subtraction 4.5 Subtraction using 1's and 2's complement. 4.6 Codes: BCD Code, Excess-3 Code, Gray Code, ASCII code. 4.7 BCD Addition, BCD Subtraction using 9's and 10's complement	12
Unit-V	5a. Draw symbol and write truth table all	5.1 Symbol, equation and truth table of AND, OR, NOT, EX-OR, EX-NOR, NOR	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Logic Gates and Boolean Algebra	the gates. 5b. State Boolean laws. 5c. Solve examples related to Boolean algebra.	and NAND gate. 5.2 NOR and NAND gate as universal gates. 5.3 Fundamental concepts of Boolean algebra, Basic Laws: Cumulative, Associative, Distributive, De-Morgan's Theorem	
Unit-VI **Combinational And Sequential Circuits**	6a. Draw and Explain Adder and subtractor. Explain different types of multiplexers and demultiplexers, encoder, decoder circuit 6b. Draw circuit of different flip-flops using logic gates and explain its operation. 6c. Explain different types of semiconductor memories and data convertors	6.1 Definition of combinational logic circuit, half adder, full adder, half subtractor. Study of IC-7483BCD to 7-segment decoder. 6.2 Multiplexer- Types (2:1, 4:1), necessity, application, study of IC-74151(pin diagram), Demultiplexer-Types, (1:2, 1:4), necessity, application, 6.3 Encoder- Definition, types, priority encoder, decoder-definition, types, (2:4 and 3:8) 6.4 Define sequential circuit, compare combinational and sequential circuit, Edge and Level triggered concept. 6.5 Flip Flops: S R flip flop using NAND gates, clocked SR flip flop with present and clear, clocked JK flip flop with present & clear, Master slave JK flip-flop, D and T flip flops. (symbol, truth-table and operation 6.6 Counter: Introduction, Types of counter. Asynchronous counter- ripple counter and decade counter. 6.7 Types of semiconductor memories: classification, ROM, PROM, EPROM, EEPROM, RAM-Static, Dynamic 6.8 Data convertors :ADC/DAC :successive approximation ADC, dual slope ADC, binary weighted resistor DAC	14
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A Level**	**Total Marks**
I	Operational amplifiers	04	08	-	12
II	Operational amplifier basic circuits	06	04	04	14
III	Applications of operational amplifier	02	08	04	14
IV	Number systems	02	08	04	14
V	Logic gates and Boolean algebra	04	08	-	12
VI	Combinational and sequential circuits	02	08	04	14
	TOTAL	**20**	**44**	**16**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain. (Perform Any TEN* **ASSIGNMENTS/PRACTICALS/TASKS** listed below)

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1.	II	Assemble inverting amplifier and non inverting amplifier using IC741 and verify equation for gain.	04
2.	II	Trace adder or subtractor circuit using IC 741and calculate the output voltage.	02
3.	II	Observe input & output waveforms of differentiator/integrator using IC741 for following input, sine waveform and square waveform	02
4.	III	Assemble a zero crossing detector circuit using IC 741 and observe Input & Output Waveform.	02
5.	III	Observe the input/output waveforms of Schmitt trigger using IC741.	02
6.	V	Verify truth table of NOT and, OR, EX-OR, NAND gates.	02
7.	VI	Verify truth table of Half and Full adder.	02
8.	VI	Verify truth table of JK flip-flop	02
9.	VI	Verify truth table of RS flip-flop	02
10.	VI	Verify truth table of D and T flip-flop	02
11.	VI	Trace and verify Decade counter using IC-7490.	04
12.	VI	Verify truth table of 4:1 Multiplexer using IC 74151	02
13.	VI	Study of DAC and ADC	02
14.	VI	Study of Memory	02
TOTAL			**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect datasheets of different operational amplifier ICs.
2. Assignments on the design of different circuits using operational amplifier.
3. Collect information related to other linear IC like instrumentation amplifier.
4. Prepare a comparative chart of different types of op- amp used in industrial purpose.
5. Download data sheets of IC-7400, 7404, 7408, 7432, 7486.
6. Download data sheets of IC-74151, 7483, 7490,
7. Collect price list of various components required to implement digital circuit.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Expert lecture from industrial person or academician

2. Show videos /power point presentation from renowned experts in the area of linear electronics/digital electronics stream
3. Show video/animation film to demonstrate the working of various combinational and sequential circuits.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Operational Amplifiers	R. Gaikwad	Prentice-hall of India, New Delhi ISBN No. 0750656948
2	Integrated Circuits	K. R. Botkar	Khanna Publisher, New Delhi ISBN No. 8174092080
3	Modern digital electronics	R. P. Jain	Tata McGraw-Hill Education Pvt. Ltd. (TMH) Fourth Edition
4	Digital Principles and Applications	Malvino Leach	McGraw-Hill Education Eighth edition
5	Digital electronics: an introduction to theory and practice	William H. Gothmann	Prentice-Hall 1977
6	Analog and digital electronics	A.P. Godse, U.A. Bakshi	Technical publication, Pune ISBN 9788184314007

B) Software/Learning Websites

1. http://www.wisc-online.com
2. http://www.electronics-tutorials.ws/opamp
3. http://www.allaboutcircuits.com/
4. http://www.electronicdesign.com/
5. http://www.asic-world.com/digital/tutorial.html
6. http://en.wikibooks.org/wiki/Digital_Circuits

C) Major Equipments/ Instruments with Broad Specifications

1. CRO (100Mhz)
2. Multimeter (3and1/2 digit digital),
3. Bread board, LED
4. Regulated power supply
5. IC741, connecting wires
6. IC74151, 7490
7. Experimental kits of combinational circuits
8. Experimental kits of sequential circuits

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	L								
CO2			H		L						
CO3		H	M	L							
CO4	M	H									
CO5		M	H								
CO6		H									
CO7			H		H						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Network (ENW) **COURSE CODE :** 6229

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	01	02	07	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

This course intends to teach the students facts, concepts and principles of circuits and circuit analysis so that he/she can use the knowledge in acquiring supervisory skill to assist in carrying out the analysis & investigation work.

2.0 COURSE OBJECTIVES:

The student will be able to:

1. Understand the circuit terminology and fundamentals of AC circuit.
2. Describe the different parameters of AC circuits and their inter relationships.
3. Understand the response of RLC elements to AC supply.
4. Understand AC series and parallel circuits and interpret them.
5. Describe the inter relationship between phase and line values for 3 –φ AC circuits.
6. Apply different circuit theorems to solve basic circuit problems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Compare different types of electric supply/sources.
2. Analyse the single and three phase A.C. quantities.
3. Draw waveforms & vectors of single, three phase A.C. quantities & express them mathematically.
4. Calculate the response of basic circuit elements to single phase A.C.
5. Apply the basic principles and provide solution to A.C. series, parallel and three phase circuit problems.
6. Apply different techniques and provide network solutions.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **AC Fundamentals**	1a. Explain different electrical parameters related to AC waveform. 1b. State the significance of RMS value, form factor, peak factor 1c. Describe and represent inter relationships between AC quantities mathematically and graphically.	1.1 Principle of generation of 1-ø alternating emf. 1.2 Cycle, time period, frequency, amplitude, phase, phase difference, R. M. S. value, average value, Form factor (Numerical on above) 1.3 Instantaneous equations for voltage and current of ac quantity 1.4 Vector representation of alternating quantity: ▪ Symbolic notation ▪ Trigonometrically form ▪ Exponential form ▪ Polar form (Numerical on form conversion)	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Single Phase A C Series Circuit**	2a. Describe the interrelationship of AC quantities (V, I, W, Phase angle) under different conditions for a series circuit (R-L, R-C, R-L-C) mathematically and graphically. 2b. Describe series resonance mathematically and graphically.	2.1 Waveforms, phasor diagram and expression of voltage, current and power in pure: Resistance, Inductance, Capacitance 2.2 Waveforms, phasor diagram and expression of voltage, current and power, impedance triangle, nature of power factor in R-L, R-C, R-L-C series circuit (Numerical) 2.3 Power triangle-active power, reactive power and apparent power. 2.4 Resonance in R-L-C series circuit (Numerical) 2.5 Graphical Representation of Resonance. Quality (Q) Factor coil.	12
Unit-III **Single Phase A C Parallel Circuit**	3a. Describe parallel circuit parameters 3b. Describe the interrelationship of AC quantities under different conditions for a parallel circuit mathematically and graphically. 3c. Describe parallel resonance mathematically and graphically. 3d. Compare series and parallel circuits.	3.1 Concept of susceptance, admittance and conductance 3.2 Solving AC parallel circuit by vector or phasor method, Admittance method and vector algebra. (Numerical on above) 3.3 Series equivalent of parallel circuit. 3.4 Parallel equivalent of series circuit 3.5 Parallel Resonance, Q-factor (Numerical). 3.6 Graphical representation parallel resonance. 3.7 Comparison of series and parallel resonance	12
Unit-IV **Polyphase Circuit**	4a. Compare single and three Phase circuits. 4b. Compare the star and delta connection 4c. Describe the interrelationship of Line and phase values mathematically and graphically for a star and delta circuit	4.1 Principle of generation of 3 –ø alternating emf. 4.2 Advantages of Polyphase circuit over single phase circuit. 4.3 Phase Sequence. 4.4 Types of three phase connections-Star connection and delta connection. 4.5 Concept of balanced and unbalanced load 4.6 Relation between phase and line quantities of star and delta connection. (Numerical on balanced load only)	10
Unit-V **Network Analysis – Techniques (AC & DC Circuits)**	5a. Apply source conversion techniques to give network solution. 5b. Apply different methods of providing circuit solutions.	5.1 Concept of voltage source & current source 5.2 Source conversions 5.3 Mesh analysis 5.4 Nodal analysis using voltage and current sources	08
Unit-VI	6a. Describe different types of electrical circuits.	6.1 Active and passive network, Linear and Non Linear network	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Network Theorems	6b. Apply different network theorems to give network solution.	6.2 Superposition Theorem. 6.3 Thevenin's Theorem. 6.4 Norton's Theorem. 6.5 Maximum power transfer Theorem. 6.6 Reciprocity theorem. (Numerical on 6.2- 6.6 for DC Circuits only)	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	**U Level**	**A and above Levels**	**Total Marks**
I	A C Fundamentals	02	04	04	10
II	Single phase series circuit	04	04	08	16
III	Single phase Parallel circuit	04	04	08	16
IV	Polyphase circuit	02	02	08	12
V	Network Analysis-Techniques (AC & DC circuits)	02	04	04	10
VI	Network Theorems	04	04	08	16
	TOTAL	**18**	**22**	**40**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs required
1	I	Observe the wave shape of an alternating supply on CRO and calculate average, RMS value, frequency and time period	02
2	II	Measure input current, power, power factor of R-L series circuit and plot the phasor diagram	04
3	II	Measure input current, power, power factor of R-C series circuit and plot the phasor diagram	02
4	II	Measure input current, power, power factor of R-L-C series circuit and plot the phasor diagram	04
5	III	Measure current and power factor of R-L & R-C parallel circuit.	04
6	IV	Verify the relationship between phase and line values of current and voltages and power in balanced and unbalanced star connected load	02
7	IV	Verify the relationship between phase and line values of current and voltages and power in balanced and unbalanced delta connected load.	02
8	V	Verify Superposition Theorem	04
9	V	Verify Thevenin's Theorem	02
10	V	Verify Norton's Theorem	02
11	V	Verify Maximum Power transfer Theorem	04
		TOTAL	**32**

TUTORIALS:

Sr. No.	Unit No	Tutorial Exercises (Outcomes in cognitive and affective Domain)	Approx. Hrs required
1	I	Solve numerical on AC Fundamentals and its various forms of representation	01
2	II	Solve numerical on R-L and R-C Series circuit	02
3	II	Solve numerical on R-L-C series and Resonance	02
4	III	Solve numerical on solving AC Parallel circuit by vector method and vector algebra method	02
5	III	Solve numerical on solving AC Parallel circuit by Admittance method	01
6	IV	Solve numerical on three phase Star connected balanced load	02
7	IV	Solve numerical on three phase Delta connected balanced load	02
8	V	Solve numerical on mesh analysis and Nodal analysis	01
9	VI	Solve numerical based on Superposition and Thevenin's theorem	01
10	VI	Solve numerical based on Norton's theorem	01
11	VI	Solve numerical based on maximum power transfer theorem	01
		TOTAL	**16**

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Information search on Practical applications of series and parallel resonance.
2. Data collection of various types of capacitors, resistors, inductors according to construction.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electric Circuits	David A Bell	Prentice Hall of India
2	Electrical Technology Vol- I	B L Theraja	S. Chand & Co.
3	Circuit & Network	A Sudhakar	Tata McGraw hill
4	Basic Electrical Engg.	V. N. Mittal	Tata McGraw hill

B) Software/Learning Websites

1. www.allaboutcircuits.com/vol_1/chpt_1/1.html
2. http://openbookproject.net/electricCircuits/DC/DC_5.html
3. www.kpsec.freeuk.com
4. www.howstuffworks.com/

C) Major Equipments/ Instruments with Broad Specifications

1. CRO
2. Ammeters (0-1A), (0-3A), (0-5A) (Ac & DC)
3. Voltmeters (0-75/150/250/500V) (Ac & DC)
4. Rheostats (110Ω 2.8A), (140 Ω, 1.7A), (360 Ω, 1.2A) (400 Ω, 1A)
5. Lamp Bank
6. Variable inductive load
7. 1-phase Variac (0-260V, 5A)
8. 3-phase Variac(0-470V, 15A)
9. Milliammeters (0-10mA)
10. Knife switch
11. Network Analyser

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H									
CO2	L	M	H								
CO3	M	H									
CO4	M	H									
CO5		L		H	M						
CO6	M		H								

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Measurements and Instrumentation (EMI) **COURSE CODE :** 6230

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	25	125
					Min.	32	--	40	--	--	10	--

1.0 RATIONALE:

Diploma holders have to perform number of jobs like supervision, maintenance, production, in which decision making is involved. The decisions are based on awareness of various types of measuring instruments & how to handle these instruments & range extension, therefore electrical measurement skills are very important. At the same time to get familiar with electrical machine control, Industrial process control students must understand the basics, facts, concepts & principles of instrumentation & instruments.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Identify and select the measuring instruments used for measuring electrical and non electrical quantities.
2. Classify measuring instruments based on construction, principle of operation, quantity to be measured.
3. Measure various types of resistances by suitable methods.
4. Use various methods for power, energy measurement.
5. Use appropriate transducers /sensors for given application.
6. Know the concept of signal conditioning and its working.
7. Understand working of display devices, pilot lamps.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Select proper instrument for measurement and calibration purpose.
2. Use of appropriate meter on basis of working principle, characteristics.
3. Apply methods to measure resistances of different values using suitable instruments.
4. Estimate various power, energy measurements.
5. Appreciate use of suitable transducer for measuring electrical and nonelectrical quantities.
6. Know working of signal conditioning.
7. Know operation of display devices, pilot lamps & list applications.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of Measurements**	1a. Classify measuring instruments 1b. Understand torques acting in instrument 1c. Know characteristics of measuring instruments 1d. Familiar with errors in the instrument 1e. Understand methods	1.1 Purpose of measurement 1.2 Classification of measuring Instruments. 1.3 Desirable characteristics of measuring instruments: accuracy, sensitivity, selectivity, reproducibility, precision, errors, drift 1.4 Common errors in analog Measuring instruments. 1.5 Torques acting in an instrument	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	of producing various torques 1f. Acquaint with construction & working of Instruments 1g. Familiarize with range extension	1.6 Methods of developing deflecting, controlling and damping torques in analog instrument 1.7 Principle, construction & working of PMMC, MI & Electro dynamometer type instruments. 1.8 Range extension: Shunts & Multipliers (Numerical on shunt & multipliers only) Range extension by C. T. & P. T.	
Unit-II **Power Measurement**	2a. Describe procedure of active & reactive power measurement in three phase circuit 2b. Know errors in measurement of power & their compensation 2c. Understand principles of operation of power factor meter	2.1 Power measurement in 3-phase circuit for balanced & unbalanced load conditions with one wattmeter method & two wattmeter methods. 2.2 Measurements of reactive power in 3-phase balanced load Circuit with one wattmeter method. 2.3 Errors & their compensation 2.4 Principle & Operation of Single phase electro dynamometer type power factor meter	08
Unit-III **Electrical Energy Measurement**	3a. Know working of induction type energy meters 3b. List errors in energy measurement & compensation methods	3.1 Construction & Principle of operation of single phase and three Phase induction type energy meter 3.2 Different types of Errors & their compensation 3.3 Calibration of energy meter. (Numerical) 3.4 Introduction to electronic (digital) energy meter	08
Unit-IV **Resistance Measurement**	4a. Classify resistances & Use suitable methods to measure them	4.1 Classification of resistances(Low, Medium, High) 4.2 Resistance measurement by Wheatstone bridge, Kelvin's double bridge. 4.3 Working principle and use of Megger & Earth tester.	06
Instrumentation			
Unit-V **Basics of Instrumentation system**	5a. Understand Instrumentation system 5b. Know static & dynamic characteristics 5c. Know errors in measurement	5.1 Basic block diagram of instrumentation system & its Function 5.2 Accuracy & Precision 5.3 Sensitivity & Resolution 5.4 Linearity & Nonlinearity 5.5 Repeatability & Reproducibility 5.6 Hysteresis & Drift 5.7 Speed of Response, lag, 5.8 Fidelity, Dynamic error 5.9 Errors in measurement	06
Unit-VI **Transducers**	6a. Define & Classify transducers 6b. Understand working of various types of transducers	6.1 Concept of Transducers 6.2 Classification of Transducers 6.3 Primary and Secondary Transducers 6.4 Electrical and Mechanical Transducers 6.5 Analog and Digital Transducers	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		6.6 Active and passive Transducers 6.7 Construction and working principles of Transducers 6.8 Resistive, Inductive and capacitive transducers Potentiometer (various) and strain gauge (No derivation only formula) 6.9 Types of strain gauges: unbounded, bounded, Semiconductor 6.10 Bourdon tube, Bellows, Diaphragm. 6.11 LVDT and RVDT. 6.12 RTD, Thermistor, Thermocouple. 6.13 Pyrometers (Radiation, optical, photoelectric), ultrasonic temperature Transducers. 6.14 Contacting and non contacting Transducers, Digital tachometer 6.15 Digital encoders disc type, frequency output type transducer and Reluctance pulse pick-ups.	
Unit-VII **Signal Conditioning**	7a. Describe Signal conditioning process, telemetry	7.1 Concept of signal conditioning 7.2 Block diagram of AC and DC signal conditioning and working 7.3 Introduction to Telemetry, Basic Telemetry Systems	06
Unit-VIII **Display Devices and Recorders**	8a. Describe digital display devices 8b. Understand working of recorders 8c. List pilot devices & their uses	8.1 Digital display devices (LED, seven segment only) Concept of 3 ½, 4 ½ digit, 8.2 Introduction to LCD 8.3 Necessity of Recorder in Instrumentation 8.4 Classification of Recorders. 8.5 Block diagram and working principles of strip-chart, X-Y recorder, 8.6 Pilot devices, function & applications	08
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamentals of Measurements	04	08	02	14
II	Power Measurement	02	04	04	10
III	Electrical Energy Measurement	02	04	04	10
IV	Resistance Measurement	--	02	04	06
V	Basics of Instrumentation system	04	06	--	10
VI	Transducers	02	06	08	16
VII	Signal Conditioning	--	02	04	06
VIII	Display devices & Recorders	--	04	04	08
	TOTAL	**14**	**36**	**30**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

(Any ten of the following)

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Use clamp on meter for measurement of AC/DC current	02
2	I	Measure current & voltages by low range ammeter & voltmeter respectively by C. T. & P. T.	04
3	II	Measure power in 3 phase balanced circuit by two wattmeter method	04
4	II	Measure reactive power in 3 phase balanced circuit by one Wattmeter method.	04
5	III	Calibrate single phase energy meter by direct loading	04
6	IV	Measure insulation resistance with the help of Megger	02
7	IV	Measure low resistance by suitable method	02
8	IV	Measure earth resistance using earth tester.	02
9	VI	Measure temperature using Thermocouple.	02
10	VI	Demonstrate use of Strain Gauge and measure strain	02
11	VI	Measure Displacement using Linear Variable Differential Transformer	02
12	VIII	Verify Phase Sequence of three phase supply system by using phase sequence indicator	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect makes and types of measuring instruments.
2. Collect the information related to degree of accuracy & types of instruments based on class of accuracy.
3. Collect information on biomedical instruments and know procedure to use them.
4. Identify type of instrument from symbols marked on the instrument
5. Measure the value of earth resistance of generator back up & lab installation.
6. Visit industrial exhibitions/fairs organised e.g. NIMA, IEEMA

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show computer software related to measurement.
2. Arrange a visit to Electrical Measuring and manufacturing unit.
3. Arrange expert seminar/lectures of industry persons in the area of Measurements and Instrumentation
4. Visit to industrial exhibitions

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electrical & Electronics Measurements & Instrumentation	A.K. Sawhney	Dhanpatrai & sons
2	Electrical Measurements & Measuring Instruments	N.V. Suryanarayna	S. Chand & co.
3	Fundamentals of Electrical Measurements	C.T. Baldwin	Harrap
4	Electrical Measurements & Measuring Instruments	R.K. Rajput	S. Chand & co.
5	Electrical Measurement & Measuring Instrument	Golding	Wheeler
6	Instrument Devices & System	Rangan Mani& Sharma	Tata McGraw Hill
7	Principles of Measurement & Instrumentation	Alan Morris	Prentice Hall & India

B) Software/Learning Websites

1. www.test-meter.co.uk/
2. en.wikipedia.org/wiki/Emerson_Electric_Company
3. www.electrical-installation.org
4. www.idemi.org/
5. www.davis.com
6. www.sensors-research.com/links.htm

C) Major Equipments/ Instruments with Broad Specifications

1. Kelvin bridge
2. Wheatstone bridge
3. Crompton Potentiometer
4. Single phase induction type energy meter
5. electronic energy meter
6. wattmeter
7. micro ohm meter
8. Megger
9. Earth Tester
10. LVDT
11. Educational kit for temperature control
12. Tachometer-analog and digital
13. clip on meter
14. strain gauge
15. Temperature measuring kits
16. Lux-meter
17. Measurement of Angular displacement kit
18. Phase sequence indicator

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		H			M						
CO3		H			M						
CO4		M									
CO5		M									
CO6				H						L	
CO7				H						L	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : DC Machines and Transformers(DCT) **COURSE CODE** : 6231

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

Electrical Machines are included as a major applied engineering course in Diploma programme. This course is classified at basic technology level. The treatment of the course is to explain facts, concepts, working, operations & constructional details of machines like DC Machines and transformers at later stage. Also knowledge of this course is essential to study the further courses such as Testing and Maintenance of Electrical Equipments, Switchgear and Protection, Generation and Distribution of Electrical Energy.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the principles and constructional details of DC machines and Transformer.
2. Explain the different electrical characteristics of DC motors as a drive.
3. Select the specifications of DC machines and transformers as per requirement.
4. Take precautionary measure while operating DC machine and transformers.
5. Find out performance parameters of DC machines and transformers.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify constructional parts of DC Machine
2. Calculate performance of DC Generator
3. Select particular type of DC Motor for a given application
4. Apply basic speed control strategies for DC Motor as per need.
5. Compare types of transformer according to construction.
6. Conduct electrical tests on transformer to determine its performance.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of DC Machines**	1a. State the need of DC Machines 1b. Identify different parts of DC machine 1c. State the meaning of DC Machine winding terminology 1d. Compare different types of armature windings	1.1 Definition 1.2 Necessity of DC machines 1.3 Constructional parts of DC machine and their functions. 1.4 Winding Terms: i. e. terms related to windings, types of armature windings, difference between Lap & Wave winding. (No Numerical)	06
Unit-II **DC Generator**	2a. Explain working principle of DC Generator 2b. Classify different types of DC Generators with sketches	2.1 Working principle of DC generator 2.2 Types of DC generator. 2.3 E. M. F. equation & voltage equation of DC generator 2.4 Losses in DC generator	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2c. Calculate performance of DC Generator 2d. Draw performance characteristics of different types of DC Generators 2e. Explain Armature reaction and commutation 2f. State the applications of DC generator	2.5 Power stages of DC generator 2.6 Characteristics of DC generators 2.7 Armature reaction 2.8 Commutation, methods to improve commutation. 2.9 Applications of shunt, series and compound generator. (Simple numerals on above)	
Unit-III **DC Motor**	3a. Explain working of DC Motor 3b. Describe meaning and significance of Back E.M.F. 3c. Calculate performance of DC Motor 3d. Draw performance characteristics of different types of DC Motors and accordingly state their applications 3e. Enlist and explain speed control of DC Motor 3f. Justify the need of DC Motor Starter 3g. From the given the data diagnose the problems on DC Motor.	3.1 Working principle of DC motor 3.2 Concept and significance of back emf. 3.3 Torque expression, voltage equation, speed regulation 3.4 Characteristics & applications of DC motor, (shunt, series compound) 3.5 Power Stages in DC Motor (Numerical) 3.6 Speed control of DC Motor (Numerical) 3.7 Starters of DC motor- Necessity, Three & Four point starter, simple numerals on above.	16
Unit-IV **Single Phase Transformer**	4a. Explain working of single phase transformer with sketches 4b. Describe constructional details of Transformer 4c. Classify the transformer based on various methods 4d. Derive the EMF equation of transformer and transformation ratio 4e. Explain Performance of Transformer on no load, resistive, inductive, capacitive load s with phasor diagrams 4f. Develop approximate equivalent circuit of transformer 4g. Conduct different tests on single phase transformer to determine its performance 4h. Compare ordinary two winding transformer and Autotransformer 4i. Solve numerical with respect to performance of	4.1 Introduction, Working principle of transformer, 4.2 Constructional parts and their functions. 4.3 Materials used for construction. 4.4 Classification of transformer. 4.5 EMF equation of transformer (derivation), Transformation ratio, 4.6 Concept of ideal transformer. 4.7 Transformer on no load- Vector diagram & numerical. 4.8 Transformer on load – phasor diagram of loaded transformer 4.9 Magnetic leakage and kVA capacity of transformer. 4.10 Equivalent circuit diagram of transformer. 4.11 Efficiency & Losses in Transformer and regulation of transformer 4.12 Method to find losses and efficiency and regulation of transformer (OC & SC test). 4.13 All day efficiency of 1-ø transformer. 4.14 Single phase Autotransformer, principles, advantages and	18

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	single phase transformer	disadvantages 4.15 Polarity of transformer. 4.16 Isolation Transformer 4.17 Simple numerals on above	
Unit-V **Three Phase Transformer**	5a. Compare Single Three phase transformer with bank of three single phase transformers 5b. Sketch the different types of connections of 3 Phase transformer including vector groups 5c. State the applications of Three phase autotransformer 5d. State the purpose and precautions to be taken while using Instrument Transformers. 5e. Solve numerical on three phase transformer 5f. Describe Scott connections of transformer	5.1 Concept of three phase transformer and its comparison with bank of three single phase transformers 5.2 Connections & their importance 5.3 Vector groups 5.4 Three Phase auto transformer 5.5 Applications of all types (Numerical on calculations of V, I & kVA capacity) 5.6 Concept and fundamentals of instrument transformer 5.7 Introduction to Scott connection	10
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basics of DC Machines	04	04	00	08
II	DC Generator	04	08	04	16
III	DC Motor	04	10	04	18
IV	Single Phase Transformer	08	10	08	26
V	Three Phase Transformer	04	06	02	12
	TOTAL	**24**	**38**	**18**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Write a Report on the electrical machine Laboratory in terms of practicing of reading name plates of various machines and their supply system.	02
2	I	To study the constructional parts of DC Machine.	02
3	II	To determine regulation of separately excited DC shunt generator from load characteristic.	02
4	II	To plot Load characteristic of DC shunt & series generator.	04
5	II	To plot load characteristic of differentially compounded generator.	02
6	III	Speed control of DC shunt motor i) above normal speed control method ii) Below normal speed control method.	04
7	III	To reverse rotating directions of DC shunt motor.	02
8	III	Load test on DC shunt motor & calculation of efficiency, output, torque etc.	04
9	IV	To find transformation ratio of single phase transformer.	02
10	IV	To measure performance of single phase transformer by direct loading method.	02
11	IV	To perform O. C. & S. C. test on single phase transformer for finding efficiency & regulation of transformer.	04
12	V	To calculate transformation ratio of three phase transformer.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare charts, models of different types of DC machines / transformers.
2. Collect data of industry / domestic drive and type of DC motor used in it.
3. Survey the market to collect specification and cost of different type of DC Machines and Transformers available in the market.
4. Collect information related with modern trends / technologies in transformer

8.0 MSPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Demonstrate different parts and working concepts of DC Machine / Transformer by using Model / Video / animations
2. Arrange a visit to nearby Substation or Transformer Manufacturing / Repairing Industry to get acquainted with different parts, accessories of transformer
3. Arrange expert seminar of industry person in the area of Transformer.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A text book of Electrical technology Vol II	B. L. Theraja A. K. Theraja	S. Chand & Co.
2	Electrical Machines	S. K. Bhattacharya	Tata McGraw Hill
3	Electrical Technology	E. Hughes	E. L. B. S.
4	Electrical Technology	H. Cotton	E. L. B. S.
5	Electrical Machine	Nagrath I.J. and Kothari D.P.	Tata McGraw Hill

B) Software/Learning Websites

1. http://www.nptel.com
2. http://www.learnerstv.com
3. www.howstuffworks.com
4. www.vlab.com

C) Major Equipments/ Instruments with Broad Specifications

1. **DC shunt generator: DC shunt motor set**
   DC shunt generator:-
   KW:- 1, RPM :-1500 rpm,
   Armature Ampere :- 4 amp, Armature output Volt :- 230,
   Field Volt :- 230, Field ampere :- 0.4 ampere,
   Insulation class: B, Rating: Cont.
   DC shunt Motor :-
   KW:- 1, RPM :-1500 rpm,
   Armature Ampere :- 4 amp, Armature Volt :- 230,
   Field Volt :- 230, Field ampere :- 0.4 ampere, Winding :- Shunt
   Insulation class: B, Rating: Cont
2. **DC series generator: DC shunt motor set**
   DC series generator:-
   KW:- 3, RPM :-1440 rpm,
   Armature Ampere :- 13.7 amp, Armature output Volt :- 230,
   Insulation class: F, Rating: Cont
   DC shunt Motor :-
   KW:- 3.7, RPM :-1440 rpm,
   Armature Ampere :- 20 amp, Armature Volt :- 230,
   Field Volt :- 230, Winding :- Shunt
3. **DC Differential compound generator: DC shunt motor set**
   DC Differential Compound generator:-
   KW/HP:- 1.1, RPM :-1500 rpm,
   Armature Ampere :- 5.0/6.2 amp, Armature Volt :- 230,
   Field Volt :- 220, Field ampere :- 0.2/0.5 ampere, Winding :- Comp
   DC shunt Motor :-
   KW/HP:- 1.1, RPM :-1500 rpm,
   Armature Ampere :- 5.0/6.2 amp, Armature Volt :- 230,
   Field Volt :- 220, Field ampere :- 0.2/0.5 ampere, Winding :- Shunt
4. **DC Shunt Motor**
   KW/HP:- 1.1, RPM :-1500 rpm,
   Armature Ampere :- 5/6.2 amp, Armature Volt :- 220 V,
   Field Volt :- 220, Field ampere :- 0.2/0.5 ampere, Winding :- Comp
   Insulation class: B, Rating: Cont
5. **Single Phase Transformer**
   Rating : 2kVA, Type: Shell, LV: 110V, HV:230
6. **Single phase Autotransformer:**
   Range: 0-270V, Input: 240V, Output: 300V, Current: Capacity15 Amp.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2			H			L					
CO3		H			L						
CO4				H	M						
CO5		H									
CO6			H								

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Material and Workshop (EMW) **COURSE CODE** : 6232

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
02	--	04	06	--	Max.	--	--	--	--	25	50	75
					Min.	--	--	--	--	10	20	--

Note: Term work evaluation will be on Part A & B.

1.0 RATIONALE:

A sound knowledge of the properties, characteristics, applications and limitation of engineering materials is a must for every engineer and technologist. It helps a technician to study useful data and select materials from manufacturers catalogues.

A technician should also have the practical skills regarding wiring and fault finding. These skills will be developed when he/she actually performs the workshop.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the different material classes used in electrical Engineering.
2. Describe the different material properties and characteristics which are exploited to drive emerging technologies.
3. Know the selection of materials required for different electrical system.
4. Use different tools for electrical system installation, maintenance and observe safety while working with electrical systems.
5. Read electrical connection for any system to understand the working of the system and its components.
6. Prepare trouble shooting and maintenance check points.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Classify and describe the properties electrical engineering materials.
2. Select the proper materials for the various components of electrical system.
3. Demonstrate installation and operations of domestic appliances
4. Find the fault and remedies of domestic appliances by reading the electrical diagram.
5. Check the connection diagram of the electrical system during installation and fallow all safety practises.
6. Trace connection diagram of the electrical system, equipments and their control circuit.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Part A (Electrical Materials) (To be studied in Theory Lecture)			
Electrical Engineering Materials	1a. Describe uses of electrical engineering materials 1b. Classify electrical engineering materials 1c. Describe properties	1.1 Introduction to Electrical Engineering Materials. 1.2 Applications of the Electrical Engineering Materials. 1.3 Classification of electrical engineering materials according to material properties like Electrical, Mechanical, Physical, Chemical & Thermal etc	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	of electrical engineering materials 1d. Describe uses of electrical engineering materials	1.4 Properties of conducting materials 1.5 Applications of conducting materials 1.6 Classification of Insulating Material 1.7 Insulating Material Properties a. Electrical properties-Volume resistivity, break down voltage, dielectric strength/constants. b. Mechanical properties. c. Thermal properties. d. Chemical properties and physical properties, 1.8 Insulation Classes 1.9 Applications of Insulating materials 1.10 Magnetic materials Classification, Diamagnetic Materials, Paramagnetic Materials, Ferromagnetic Materials, ferrite materials. Soft and hard magnetic materials. 1.11 Properties of Magnetic materials 1.12 Applications of magnetic materials	
Part B (Workshop)			
Workshop	**1B-1.** Understand safety rules **1B-2.** Able to use safety devices	1.1 General safety precautions and related IE Rules, 1.2 Various tools required for electrical wiring and electrical work and their use. 1.3 Safety devices such as Hand gloves, gumboot, mats tester, arms panel, life safety materials are to be studied with etc with their specifications, test as per IS, also permissible or withstand company of such material to specified voltage & current. First aid method information with video demonstration.	02
	2B-1. Able to identify types and sizes wires	2.1 Construction, Underground cables, Types of 3-Phase cables, Cable lying, filling compound in sleeve, Cable jointing and crimping.	02
	3B-1. Able to demonstrate operation of home appliances	3.1 Installation/operational demo and fault identifications of Home appliances such as automatic electric iron, washing machines, fans, oven, induction segri, Geyser, bell, mixer etc with their specification.	04
	4B-1. Able to understands to connection diagram of lamps	4.1 Wiring Connections of Fluorescent tube lights, Sodium/ Mercury vapour lamp and indoor outdoor LED lamps. Identify and rectify faults in above lamps.	04
	5B-1. Able to check machine earthing, alignment,	5.1 Checking the earthing of given machine / panel, tightening of incoming and outgoing connections, checking alignment in case of machines, checking the	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	connection and brush tension	terminal plates of the machine, checking brushes and brush pressure in case of DC & Slip ring motors etc.	
	6B-1. Able to check the power contractor	6.1 Case study of the contractor to demonstrate construction, connection and automatic and non automatic operation.	02
	7B-1. Understand solar panel working	7.1 Solar panel components and their connection and specification. Installation procedure of solar panel.	02
	8B-1. Able to trace LED lamp connection	8.1 Connection of driver and Components of LED Lamp with specifications.	02
TOTAL			**32**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 SUGGESTED EXERCISES/PRACTICALS (Workshop)

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I to VI	Collect at least three samples of each category of materials (such as conducting, insulating, magnetic). To be submitted along with termwork of workshop. Prepare report of source of collection, properties and applications.	08
2	On Part B (Workshop)	To Demonstrate types and use of various tools required for installation/maintenance of electrical work.	04
3		To Demonstrate the use of safety devices and precaution while working on electrical installation	06
4		To Demonstrate video of Artificial respiration method used during rescue of person suffering from electrical shock.	06
5		To prepare and check the distribution switch board of minimum four point, by using test lamp check the fault in electrical equipment.	08
6		To demonstrate Installation and operation of any two home appliances and identify possibilities of different faults in such appliances.	06
7		To Identify and rectify faults in lamps Fluorescent tube lights, Sodium/ Mercury vapour lamp and indoor outdoor LED lamps. (Any two Lamps)	10
8		To check the earth resistance of the installed machine, incoming terminals connection and the brush tension. (for DC /AC slip ring motor)	08
9		To check the contactor operation and demonstrate construction, connection and automatic and non automatic operation (power Contactor).	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1 Collect from market the catalogues of home appliances.
2 Collect the information on solar generation from nearby place
3 Trace the connection diagram of control circuit of any equipment in lab
4 Collect the domestic manufacturers list.

5 Collect the electrical engineering material suppliers and manufacturers list.
6 Collect the maintenance schedule information of domestic appliances.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration on safety precaution and measures taken during electrical accidents.
2. Arrange a visit to solar power plant to understand the plant components and their working.
3. Arrange expert seminar of industry person in the area of electrical safety

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electrical Engineering Materials	A.J. Dekker	Prentice Hall of India Pvt. Ltd., Delhi.
2	Electrical Engineering Materials	Indulkar	S. Chand Publication, Delhi
3	Electrical Wiring, Estimating and Costing	Uppal, S.L. & Garg, G.C.	Khanna Publication, New Delhi
4	Electrical Estimating & Costing	Surjit Singh	Dhanpat Rai & Co. New Delhi
5	Electrical Workshop	R.P. Singh	I.K. International Publishing House
6	Electrical Design Estimating Costing	K.B. Raina S.K. Bhattacharya	New Age International Publishers

B) Learning Websites

1. http://www.nsci.org.in/
2. http://www.esfi.org/
3. http://www.osha.gov/Publications/electrical_safety
4. http://www.nfpa.org/safety

C) Major Equipments/ Instruments with Broad Specifications

1. Various safety devices for protection of electrical installation and earth tester, megger, resistance tester etc.
2. Different types of cables, wires, switches, Fluorescent lamp, Sodium/ Mercury vapour lamp and indoor outdoor LED lamps etc.
3. Various domestic appliances as follows : (a)Washing Machine, (b)Air-conditioner, (c)Refrigerator, (d)Vacuum Cleaner, (e)Water filter, (f)Food processor, (g)Electric Greaser, (h)Electric Iron (automatic)

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		M									
CO3			H						M		
CO4		M			H						
CO5						H					
CO6			M								

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Computer Programming (CPR) **COURSE CODE** : 6233

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	25	--	25	50
					Min.	--	--	--	10	--	10	--

1.0 RATIONALE:

C is general purpose structural language that is powerful, efficient and compact, which combines features of high level language and low level language. It is closer to Man and Machine both. Due to this inherent flexibility and tolerance it is suitable for different development environments. Due to these powerful features C has not lost its importance and popularity in recently developed and advanced software industry C can also be used for system level programming, C is still considered as first priority programming language.

This course covers from the basic concept of C to Structure in C. This course will act as "programming concept developer" for students. It will also act as "Backbone" for courses like OOPS, VB, Windows Programming, JAVA, OOMD etc.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Describe the concepts of constants, variables, data types and operators.
2. Develop programs using input and output operations.
3. Write programs using different looping and branching statements.
4. Write programs based on arrays and strings handling functions.
5. Write programs using functions.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Explain the concept of c.
2. Explain operators& data input and output functions
3. Implement and understand decision making and looping.
4. Explain concept of array and string.
5. Learn how to create a functions and understand the categories of function.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of C**	1a. State the history of C 1b. Draw Basics structure of c 1c. Know the Turbo C editor.	1.1 History of C 1.2 Basics of Algorithm and Flowchart in C, Steps for executing a C program 1.3 Character set, constants, variables, expressions, data types in c, keywords, declaration of variable and constants. 1.4 Structure of C program, Rules for writing a C program	02
Unit-II **Operators,**	2a. Enlist an Operator 2b. Explain Input and Output Library	2.1 Arithmetic Operators 2.2 Assignment Operator 2.3 Relational, Logical and conditional	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Data Input and Output Functions	Functions	Operators, 2.4 getchar(), putchar(), gets() and puts()	
Unit-III **Decision Making in 'C'**	3a. Know the basics of decision making and branching. 3b. Use and apply controlled looping.	3.1 Decision making and branching : if Statement, nested if-else 3.2 Switch, break, continue, 3.3 Control looping : While, do – while, for Statements.	04
Unit-IV **Arrays and Strings**	4a. Know the basics of array and string	4.1 Declaration and initialization of one dimensional and two dimensional array 4.2 Declaration and initialization of string variables, string handling functions from standard library [strlen(), strcpy(), strcat(), strcmp()].	05
Unit-V **Functions**	5a. Explain the basics of functions	5.1 Need of functions, defining functions, function call, return values.	03
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Basics of turbo 'C' compiler	01
2	I	To draw Flowchart and algorithm for addition of two numbers.	01
3	III	To find greatest/ smallest of 3 numbers. (use if, if else, nested if)	02
4	III	To find even or odd numbers by accepting input from user.	02
5	III	Display menu 1. Addition 2. Subtraction 3. Multiplication 4. Division and execute it using switch-case.	04
6	III	To implement 'continue' and 'break' statements	02
7	IV	To display all even numbers from 1-100.	02
8	IV	To find smallest / largest number from array elements	04
9	IV	To sort array elements in ascending / descending order.	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
10	IV	To calculate addition / subtraction of 2 dimensional matrix.	04
11	V	To calculate area of circle using function.	02
12	V	To find the given power of number using function	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Find out errors from various programs in (faculty should give at least five programs which have errors.)
2. Students should perform tracing of variables using watch window.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Demo lectures with power point presentations using LCD projector should be arranged to develop programming concepts of students.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Programming in 'C'	E. Balgurusamy	Tata McGraw Hill
2	Let us 'C'	Yashavant Kanetkar	BPB
3	Complete reference C	Herbert Shildt	Tata McGraw Hill
4	The C Programming Language	Brian Kernighan and Dennis Ritchie	Paperback

B) Software/Learning Websites

1. http://www.iu.hio.no/~mark/CTutorial/CTutorial.html
2. http://apex.vtc.com/c-programming.php
3. http://www.eskimo.com/~scs/cclass/cclass.html
4. http://www.cprogramming.com/tutorial/c/lesson1.html

C) Major Equipments/ Instruments with Broad Specifications

Hardware	Intel Pentium Processor N3700 (2M Cache, up to 2.40 GHz), Windows 10 Home 64bit English, 2GB (1x2GB) 1600MHz DDR3L Memory, 500GB 5400 rpm Hard Drive, 19.5-inch HD+ (1600 x 900) Anti-Glare LED-Backlit Display, 2GB (1x2GB) 1600MHz DDR3L Memory, 500GB 5400 rpm Hard Drive, Intel HD Graphics, Tray load DVD Drive (RW to DVD/CD), **Ports Side** 2 USB 3.0 **Rear** 2 USB 2.0, 45 – RJ 10/100/1000 Gigabit, Wireless Keyboard and Mouse-KM636 - US International (QWERTY) – Black, Wireless mouse included with Keyboard
Software	Borland Turbo C Compiler/Editor

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
CO1	L	M	H								M
CO2	M	H	H	H					M		L
CO3	M	H	H	M					L		M
CO4	M	H	H	M					M		L
CO5	L	H	M	M					M		L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Applied Mathematics (AMT) **COURSE CODE** : 6301

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The study of mathematics is necessary to develop in the students the skills essential for new technological development. This course introduces some applications of engineering, through which the students can understand mathematics with engineering principles.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire knowledge of mathematical terms, concepts, principles and different methods.
2. Develop ability to apply mathematical method to solve engineering problems.
3. Acquire sufficient mathematical technique necessary for practical problems.
4. Apply the relation between mathematics and applications in engineering.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to solve engineering and applied mathematical problems using

1. Methods of integration
2. Definite integral and its application
3. Differential equation and its application
4. Numerical methods for solving algebraic and simultaneous equations
5. Laplace's transform.
6. Probability distribution.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Integration**	1a. Solve integration problem using rules and formulae 1b. Apply method of integration for solving problem	1.1 Definition of integration, integral as anti- derivative, integration of standard functions. 1.2 Rules of integration (Integral of sum or difference of functions, scalar multiplication) 1.3 Methods of integration. a. Integration by method of substitution & by using trigonometric transformation b. Integration of rational functions & by method of partial fraction c. Integration by parts	12
Unit-II **Definite Integration And Its**	2a. Apply definite integration to solve engineering problems, area Volume, R.M.S.	2.1 Definite Integration a. Definition of definite integral b. Properties of definite integral with simple problems c. Application of definite integration	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Application	value.	Area under curve, area bounded by two curves. Volume generated by revolution of curve, RMS value & mean value.	
Unit-III **Differential Equations**	3a. To form and solve Differential Equation 3b. Apply various method to solve differential equations 3c. Solve engineering problems using differential equation.	3.1 Definition of differential equation, order and degree of differential equation. Formation of differential equation for function containing single or double constants. 3.2 Solution of differential equations of first order and first degree such as a. Variable separable form b. Reducible to variable separable c. Homogeneous differential equation d. Linear differential equation e. Bernoulli's differential equation. 3.3 Applications of differential equations.	08
Unit-IV **Numerical Methods**	5a. Solve algebraic equations by using Bisection method and Newton Raphson Method 5b. Solve simultaneous Equations by using Gauss-Seidel method and Jacobi's method 5c. Apply Lagrange's interpolation formula and Newton forward interpolation formula	4.1 Solution of algebraic equations using iterative method a. Bisection method b. Newton-Raphson method. 4.2 Solution of simultaneous equations containing three unknowns – iterative methods a. Gauss-Seidel method b. Jacobi's method 4.3 Interpolation a. Lagrange's interpolation formula b. Newton's forward difference 4.4 Interpolation formula	08
Unit-V **Laplace transform**	5a. Acquire knowledge of Laplace transform and Inverse Laplace transform. 5b. Apply Laplace Transform to solve Differential Equations.	5.1 Definition of Laplace transform and standard formulae of Laplace transform 5.2 Properties of Laplace transform (linearity, first & second shifting, multiplication by t^n, division by t) 5.3 Inverse Laplace transform, using partial fraction 5.4 Laplace transform of derivatives 5.5 Application of Laplace transform for solving differential equation.	06
Unit-VI **Probability Distribution**	6a. Apply Binomial Distribution 6b. Apply Poisson's Distribution 6c. Apply Normal Distribution	6.1 Binomial distribution 6.2 Poisson's distribution 6.3 Normal distribution (simple examples)	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Integration	04	08	08	20
II	Definite integration and its application	04	04	04	12
III	Differential equations	04	08	04	16
IV	Numerical methods	04	04	08	16
V	Laplace transform	02	04	02	08
VI	Probability distribution	02	04	02	08
	TOTAL	**20**	**32**	**28**	**80**

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Unit wise home assignment, containing ten problems.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Teacher guided self learning activities.
2. Applications to solve identified Engineering problems and use of Internet.
3. Learn graphical software: Excel, DPlot, Graph etc.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Mathematics for polytechnic student (III)	S. P. Deshpande	Pune Vidyarthi Gruha
2	Applied Mathematics	Kumbhojkar	Phadake Prakashan
3	Numerical Methods	S. S. Sastry	Prentice Hall Of India
4	Text book of Applied Mathematics, Volume I&II	P. N. Wartikar, J. N. Wartikar	Pune Vidyarthi Gruha Pune

B) Software/Learning Websites

1. http://www.mathsisfun.com/calculus/integration-definite.html
2. http://www.intmath.com/applications-integration/applications-integrals-intro.php
3. http://www.maths.surrey.ac.uk/explore/vithyaspages/differential.html
4. http://tutorial.math.lamar.edu/Classes/DE/LaplaceIntro.aspx
5. http://library2.lincoln.ac.nz/documents/Normal-Binomial-Poisson.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. Scientific Calculator
2. Computer system with Printer, Internet system.
3. LCD Projector.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H		M								L
CO2	H		M								L
CO3	H		M								L
CO4	H		M								L
CO5	H		M								L
CO6	H		M								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Environmental Studies (EVS) **COURSE CODE** : 6302

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	02	02	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis.

It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, forests.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand and realize nature of the environment, its components and inter-relationship between man and environment.
2. Understand the relevance and importance of the natural resources in the sustainability of life on earth and living standard.
3. Comprehend the importance of ecosystem and biodiversity.
4. Identify different types of environmental pollution and control measures.
5. Correlate the exploitation and utilization of conventional and non-conventional resources.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Explain uses of resources, their overexploitation and importance for environment
2. Describe major ecosystem
3. Suggest measurers for conservation of biodiversity
4. Identify measures for prevention of environmental pollution
5. Describe methods of water management
6. Identify effects of Climate Change, Global warming, Acid rain and Ozone layer
7. Explain Concept of Carbon Credits
8. State important provisions of acts related to environment

4.0 COURSE DETAILS:

There are no separate classes for theory. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Importance of Environmental Studies**	1a. Define the terms related to Environmental Studies 1b. State importance of awareness about environment	1.1 Definition, Scope and Importance of the environmental studies 1.2 Need for creating public awareness about environmental issues
Unit-II **Natural Resources**	2a. Define natural resources 2b. Identify uses of natural resources, their overexploitation and importance for environment	2.1 Uses of natural resources, overexploitation of resources and importance for environment 2.2 Renewable and Non-renewable resources 2.3 Forest Resources 2.4 Water Resources 2.5 Mineral Resource 2.6 Food Resources
Unit-III **Ecosystems**	3a. Define Ecosystem 3b. List functions of ecosystem 3c. Describe major ecosystem in world	3.1 Concept of Ecosystem 3.2 Structure and functions of ecosystem 3.3 Major ecosystems in the world
Unit-IV **Biodiversity and its Conservation**	4a. Define biodiversity 4b. State levels of biodiversity 4c. Suggest measurers for conservation of biodiversity	4.1 Definition of Biodiversity 4.2 Levels of biodiversity 4.3 Threats to biodiversity 4.4 Conservation of biodiversity
Unit-V **Environmental Pollution**	5a. Classify different types of pollution 5b. Enlist sources of pollution 5c. State effect of pollution 5d. Identify measures for prevention of pollution	5.1 Definition, Classification, sources, effects and prevention of • Air pollution • Water Pollution • Soil Pollution • Noise Pollution 5.2 E- waste management
Unit-VI **Social Issues and Environment**	6a. Describe methods of water management 6b. Identify effects of Climate Change, Global warming, Acid rain and Ozone Layer 6c. Explain Concept of Carbon Credits	6.1 Concept of sustainable development 6.2 Water conservation, Watershed management. Rain water harvesting: Definition, Methods and Benefits. 6.3 Climate Change, Global warming, Acid rain, Ozone Layer Depletion, 6.4 Concept of Carbon Credits and its advantages
Unit-VII **Environmental Protection**	7a. State important provisions of acts related to environment	7.1 Importance of the following acts and their provisions: • Environmental Protection Act • Air (Prevention and Control of Pollution) Act • Water (Prevention and Control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Population Growth: Aspects, importance and effect on environment • Human Health and Human Rights • ISO 14000

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

SR. No.	Unit No.	Practical Exercises	Approx. Hrs. required
1	I	Report on Importance and public awareness of Environmental Studies.	04
2	II	Report on Use of natural resources and overexploitation of Resources	04
3	II	Visit /Video Demonstration to Renewable / Non-renewable (wind mill, hydropower station, thermal power station)/ resources of energy.	04
4	II	Visit to polyhouse and writing report on its Effects on agriculture food production.	04
5	III	Assignment/Report on structure and functions of ecosystem.	04
6	IV	Visit to a local area to environmental assets such as river / forest / grassland / hill / mountain and writing report on it.	04
7	V	Group discussion on Environmental Pollution (Air pollution/Water pollution/Soil pollution/Noise pollution/E-waste)	04
8	V	Visit to study recycling of plastic and writing a report on it.	04
9	VI	Visit to Water conservation site / Watershed management site / Rain water harvesting site and writing a report on it.	04
10	VI	Visit to study organic farming/Vermiculture/biogas plant and writing a report on it.	04
11	VI	Video Demonstration /Expert Lecture Report on Climate Change and Global warming	04
12	VII	Write important provisions of Acts related to Environment/ Air (Prevention and Control of Pollution) Act/Water (Prevention and Control of Pollution) Act/ Wildlife Protection Act/ Forest Conservation Act	04
		TOTAL	**32**

Note: Any Four Visits/ Video Demonstration and Four Reports/Assignments from above list to be conducted.

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1) Collect articles regarding Global Warming, Climate Change
2) Collect information regarding current techniques, materials etc. in environmental system.
3) Tree plantation and maintenance of trees in the Campus.
4) Cleanliness initiative (Swachhata Abhiayan)

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Course Video
2. Expert Lectures

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Environmental Studies	Erach Bharucha	Universities Press (India) Private Ltd, Hyderabad
2	Environmental Studies	Dr. Suresh K Dhameja	S K Kataria & Sons New Delhi
3	Basics of Environmental Studies	U K Khare	Tata McGraw Hill

B) Software/Learning Websites

Not Applicable

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	H	M			M	H					M
CO2	H	M			M	H					M
CO3	H	M	M		M	H			M		M
CO4	H	M		M	M	H		M		M	M
CO5	H	M			M	H					M
CO6	H	M			M	H	M				M
CO7	H	M			M	H					M
CO8	H	M			M	H					M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in ME / PS / EE / IF / CM / EL / AE / DD
COURSE : Industrial Organization and Management (IOM) **COURSE CODE** : 6303

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

Diploma engineer has to work in organization. One must know how organization works, structure of organization, departments & their roles in organization. One should be familiar with concept of organization & its importance in management.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the concepts of organization.
2. Resolve the major challenges in the design of an effective organizational structure.
3. Develop critical thinking, research, oral and written communication skills.
4. Promote an understanding to create organizational values and satisfy their stakeholders.
5. Know the preventive measures for accidents and safety.
6. Apply the various tools for scientific management.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify the organization and its types with ownerships.
2. State the principles of management with different levels.
3. Describe the types of accidents and its measures.
4. Work as a production supervisor and store officer.
5. Co-ordinate the functions of HRM and Marketing departments.
6. Use the practices of CPM/PERT and Supply Chain Management.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Organization and Ownerships**	1a. Describe organization and its types 1b. State various types of ownership firms	**a. Organization** 1.1 Concept of organization 1.2 Types of organization structures as line, line and staff, functional organizational structures, their merits and demerits. **b. Ownerships** 1.3 Proprietorship 1.4 Partnership, Types of partners, Partnership deed. 1.5 Joint stock companies, Private Limited, Public Limited, Joint Ventures. 1.6 Govt. departments, Govt. undertaking, Public corporation 1.7 Cooperative Organizations 1.8 Merits & demerits of all above mentioned types of ownership.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Scientific Management**	2a. Explain functions of scientific management 2b. State the principles of management. 2c. Describe different levels of management.	**Scientific Management** 2.1 Concept and importance of scientific management. 2.2 Principles of Management, Taylor, Fayol's Theories of management. 2.3 Functions of Management, Levels of Management and skills at different levels	06
Unit-III **Industrial Developments in India and Industrial Acts**	3a. Explain the major areas of Indian industries 3b. Describe types of accidents & safety measures 3c. State provisions of industrial acts.	**a. Industrial Developments in India** 3.1 Major areas of industry in India (Automobile, Cement, Steel and Agro industries) 3.2 Introduction of WTO and GATT **b. Industrial Acts** 3.3 Safety Management • Causes of accidents • Types of Industrial Accidents • Preventive measures • Safety procedures 3.4 Industrial Legislation - Necessity of Acts, Provisions of following acts: • Indian Factory Act • Workman Compensation Act • ▪ Minimum Wages Act	08
Unit-IV **Production and Material Management**	4a. Explain the types of production systems 4b. Describe the material management techniques 4c. State use of ERP and MRP	**a. Production Management** 4.1 Concept of production management 4.2 Types of production systems – job, batch and mass 4.3 Merits and demerits of all above production systems **b. Material Management** 4.4 Inventory Concept, its classification, functions of inventory 4.5 ABC Analysis - Necessity & Steps 4.6 Economic Order Quantity Concept, graphical representation, determination of EOQ 4.7 Standard steps in Purchasing 4.8 Modern Techniques of Material Management- JIT, KANBAN, VSM, LEAN. 4.9 Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP 4.10 Enterprise Resource Planning (ERP) - Concept, advantages & disadvantages of ERP	10
Unit-V **Marketing and Human Resource Management**	5a. Explain the functions of marketing management 5b. Describe selection procedure by HRM	**a. Marketing Management** 5.1 Concept of marketing management and importance 5.2 Functions of marketing promotion of sales, market segmentation, marketing mix, 4P's and Physical distribution.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	dept. 5c. Importance of Employee training	**b. Human Resource Management** 5.3 Recruitment selection procedure, Functions of HRM Dept. 5.4 Training of human resources- objectives, importance and methods of training	
Unit-VI **CPM/PERT and Supply Chain Management**	6a. Explain the importance of CPM/PERT 6b. Describe the need of SCM in industry	**a. CPM/PERT** 6.1 CPM & PERT – definitions of node, activity, dummy activity, resources, duration, network, earliest start time, earliest finish time, latest start time, latest finish time, float. 6.2 Drawing of network and determination of critical path. 6.3 Analysis of network. **b. Supply Chain Management** 6.4 Definition and Concept of SCM 6.5 SCM practices- Relational, Vendor Managed Inventory (VMI), Agile Manufacturing and Postponement. 6.6 Green SCM 6.7 Concept of cross docking 6.8 Case study of Wall Mart and Dell Computer	08
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	a. Organization	--	04	--	04
	b. Ownerships	02	04	--	06
II	Scientific Management	02	04	02	08
III	a. Industrial Developments in India	02	04	--	06
	b. Industrial Acts	04	04	--	08
IV	a. Production Management	02	04	02	08
	b. Material Management	02	04	02	08
V	a. Marketing Management	--	08	--	08
	b. Human Resource Management	02	06	--	08
VI	a. CPM/PERT	02	02	04	08
	b. Supply Chain Management	02	02	04	08
	TOTAL	**20**	**46**	**14**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the organization structures of manufacturing, cement, pharmacy, electrical, govt. Sectors.
2. Find out the information of above mentioned industries by internet.
3. Collect the rules of industrial acts by ILO websites.
4. Gather information about chain structures of material management by logistics' industries.
5. Collect the information about WTO and GATT by online resources.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (IF ANY):

1. Show organization structures of different industries, govt. sectors, private firms etc.
2. Arrange a visit to industries, govt. offices located at nearby areas.
3. Arrange expert seminar/lectures by a resource person from industry in the area of manufacturing, HRM, Logistics etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering & Management	Dr. O. P. Khanna	Dhanpat Rai & Sons New Delhi
2	Industrial Engineering & Management	Banga & Sharma	Khanna Publication
3	Business Administration & Management	Dr. S. C. Saksena	Sahitya Bhavan Agra
4	The process of Management	W. H. Newman E. Kirby Warren Andrew R. McGill	Prentice- Hall
5	Entrepreneurship Development & Management	Dr. R. K. Singal	S. K. Kataria & Sons, New Delhi
6	Production Planning & Control	Dr. R. K. Singal	S. K. Kataria & Sons, New Delhi

B) Software/Learning Websites

1. http://www.wto.org/
2. http://www.gatt.org/
3. http://www.worldtradelaw.net/
4. http://www.supplychainbrain.com/
5. http://www.legallyindia.com/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1				M							
CO2					L		M				
CO3		M					L				
CO4	L					H					
CO5				L							L
CO6							M				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Supervisory Skills (SSL) **COURSE CODE** : 6305

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

A diploma engineer working in the industry has to co-ordinate and supervises a group of workers. An engineer should have a leadership attitude. This course will help to develop requisite traits in the diploma engineer.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand importance of scientific management.
2. Understand the controlling performance of process & people.
3. Know organizing, staffing and training of worker.
4. Understand the importance of leadership.
5. Know industrial psychology and human relation.
6. Know safety awareness and health administration in the industry.
7. Understand role of supervisor in industry.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Explain the importance of scientific management.
2. Describe controlling performance of process & team of worker.
3. Explain the methods to train the worker.
4. State the qualities of leader.
5. Describe progressive disciplinary action to worker.
6. Enlist causes of accident and prevention of accident.
7. Explain the role of supervisor towards management and worker.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Scientific Management and Management of Job**	1a. Define the term management. 1b. Differentiate between management, administration and organisation. 1c. Explain the necessity and steps of scientific management. 1d. Describe handling complexity and its steps.	1.1 Management-definition, its job, Difference between management, administration and organization. Levels and its functions of management. 1.2 Definition, Necessity and, procedure of scientific management 1.3 Handling complexity and its steps. 1.4 Optimization and its steps.	06
Unit-II **Supervisory**	2a. Explain objective of planning by supervisory 2b. Describe the different	2.1 Planning by supervisor, necessity, steps and objectives 2.2 Budgeting at supervisory level,	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Management	types of budget. 2c. Explain the controlling of performance of team of worker in term of quantity & cost.	objective and its advantages. Types of budget. 2.3 Deciding mental & physical activities of workers. 2.4 Controlling the performance of process & team of worker in term of quantity / quality/ time/ cost.	
Unit-III **Organising, Staffing and Training.**	3a. Define organising. 3b. State physical resources needed for production. 3c. Explain staffing with human resources. 3d. Define Merit rating. 3e. Explain methods of merit rating. 3f. Describe needs & objectives of training. 3g. List types of training. 3h. Explain types of training.	3.1 Organizing effectively the department, provision of physical resources, matching human need with job need, allotment of to individual and establishing relationship among person working in a group. 3.2 Staffing with the human Resources. 3.3 Appraisal of Employee performance or merit rating and its types. 3.4 Training-definition, needs and objectives its types –induction and orientation, by skill & old worker, on job training, apprentice training, by special schools.	06
Unit-IV **Activating the Work Force**	4a. Define-Motivation. 4b. Explain the motivating factors. 4c. State qualities of leader. 4d. Explain democratic leadership. 4e. Explain need of effective communication.	4.1 Motivation –definition, types and motivating factors. 4.2 Leadership-definition, qualities of leader, Role of leadership, methods- authoritarian, democratic and lassez- faire or free rein. 4.3 Effective employee communication.	08
Unit-V **Managing Problem Performance**	5a. State symptoms of troubled employee. 5b. Explain causes of industrial dispute. 5c. Describe collective bargaining. 5d. State the causes of substandard performance. 5e. Explain progressive disciplinary action.	5.1 Counseling troubled employees-symptoms, need and guidelines for counseling. 5.2 Industrial dispute-causes, strikes, settlement of industrial dispute, collective bargaining, conciliation & mediation and arbitration. 5.3 Disciplining-definition, Substandard performance, progressive disciplinary action.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-VI **Employee Health and Safety Under OSHA**	6a. Define accident. 6b. List causes of accident. 6c. Explain the effect of accident to industry, worker and society. 6d. Describe role of OSHA	6.1 Accident-definition, Causes of accident, Prevention of accident, effect of accident to industry, worker and society, Preparation of accident report and investigation. 6.2 Occupational diseases, hazards, safety awareness. 6.3 Role of OSHA. (Occupational safety & health administration), industrial health.	06
Unit-VII **Supervisor's Role in Labour Relation.**	7a. Explain role of supervisor towards management and work. 7b. Describe function of labour union.	7.1 Role of supervisor in management/ worker/fellow Supervisor/work. 7.2 Labour or trade union-function, right and liabilities.	04
Unit-VIII **Moving up in your Organisation**	8a. Explain activities to be done at end of shift by supervisor. 8b. Describe sort of attitude and action by supervisor while moving up in organization.	8.1 Taking charge of career to know organization, Department & Worker etc. Planning the day work, activities to be done before shift start, beginning, during and end of shift. 8.2 Moving up –sort of attitude and action by supervisor	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Scientific Management and Management of Job	04	04	04	12
II	Supervisory Management	04	04	04	12
III	Organizing, staffing and Training.	04	06	--	10
IV	Activating the work force.	06	04	--	10
V	Managing problem performance.	04	04	04	12
VI	Employee Health and safety under OSHA	04	02	04	10
VII	Supervisor's role in Labour Relation.	--	06	-	06
VIII	Moving up in your organisation.	04	04	--	08
	TOTAL	**30**	**34**	**16**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare safety charts and slogan.

2. Exhibition of safety charts and slogan.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video clips on management and motivation.
2. Arrange expert lecture of industry person in the area of safety awareness in industry.
3. Show video clip on safety in industry.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering and management	O. P. Khanna	Dhanpat Rai & Sons
2	Industrial organization & Engineering Economics	Banga & Sharma	Khanna Publication
3	Industrial management	Shrinivasan	Dhanpat Rai & Sons

B) Software/Learning Websites

1. http://www.management.com
2. www.safety.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	M			H					M		M
CO2			H	M			L	M	M		
CO3		M	H	M			M		M		M
CO4	H		M			H			M		M
CO5		M			M		M		M		
CO6		M			M		M		M		M
CO7				M	M	M	M	M	M		

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE
COURSE : Marketing Management (MKM) **COURSE CODE** : 6306

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

The Marketing of product is the most important aspect of each industry. It needs to be systematically surveyed and planned as in the increasing competitive situation. An organization should have a profit for its existence. An engineer as entrepreneur, marketing set up of a company should have knowledge of marketing management. The job opportunities for an engineer in the marketing are increasing due to essentiality of person to deal the technical matter and give related feedback for improvement of product marketing function.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand various elements of market survey and design its methodology.
2. Understand the duties of marketing personal.
3. Learn the concept of pricing, branding, product mix etc.
4. Understand various marketing strategies.
5. Study various sales Forecasting methods and product diversification.
6. Acquire knowledge of various tools/techniques of Market research and product promotion.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Assess market opportunities by analyzing customers, competitors, collaborators, considering strengths and weaknesses of a company.
2. Develop effective marketing strategies to achieve organizational objectives.
3. Design a strategy implementation program to maximize its chance of success.
4. Assess scope for international marketing.
5. Use various tools/techniques of Market research and product promotion.
6. Apply various innovative ideas of advertisement for enhancing the sales.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Marketing Management Concept**	1a. Explain the needs, wants and demands of customers. 1b. Describe the concept of marketing management.	1.1 Needs, wants and Demands, Types of market demands, Products (Goods, services and Ideas), cost and satisfaction.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1c. Explain the functions of marketing management. 1d. Differentiate between selling and marketing. 1e. Explain the techniques of maximizing, consumption, customer choice and satisfaction. 1f. Distinguish between macro and micro environment. 1g. Explain techniques of maximizing consumer satisfaction, choice, product life etc.	1.2 Markets, Marketers and prospects, primary purpose of marketing management. 1.3 Simple marketing system, value exchange and transaction, functions of marketing. 1.4 The product, production and selling concept. 1.5 The marketing concept, difference between marketing and selling, the social marketing concept. 1.6 Maximize consumption, satisfaction, choice, product life, quality, customer value and consumer satisfaction, Customer – delight, life time customer. 1.7 Marketing environment – value, macro and micro environment.	
Unit-II **Marketing Management Process**	2a. Explain various types of market segmentation. 2b. Explain product life cycle. 2c. Describe 4P's of marketing. 2d. Explain the significance of different techniques in product promotion. 2e. Differentiate between Direct and Indirect marketing.	2.1 Market segmentation: Basis for segmentation- Geographic / Demographic / psychographic segmentations, benefits of Market segmentation. 2.2 Product: Concept of Product, New product development process. 2.3 Product Life cycle, Stages in PLC and Marketing Strategies. 2.4 Marketing mix: 4 P's, significance of 4P's. 2.5 Methods of marketing- Direct and Mass marketing. 2.6 Product promotion- Role of advertisement, personnel selling and internet in marketing promotion, mail marketing.	08
Unit-III **Price Decisions**	3a. Explain the significance of pricing in marketing management. 3b. Describe the different pricing methodologies.	3.1 Importance of pricing, price setting in practice 3.2 Cost oriented pricing- mark-up pricing, target pricing. 3.3 Demand oriented pricing, price discrimination. 3.4 Competition oriented pricing- going rate pricing, sealed bid pricing.	06
Unit-IV **Marketing Research**	4a. Explain the concept, scope, objectives, importance and limitation of market research. 4b. Explain various methods of data collection.	4.1 Market research – Introduction, Nature, Scope, objective, importance, limitations and issue formulation. 4.1 Source and collection of marketing data- primary data, secondary data.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	4c. Describe the market research tools and techniques. 4d. Differentiate between primary data and secondary data.	4.2 Methods of collection of primary data- observation, mail, personal interview, television etc. 4.3 Market Research Techniques- National Readership survey, consumer panel, test marketing.	
Unit-V **Advertising and sales management**	5a. Explain the concepts of marketing communication. 5b. Explain the different types of sales promotions. 5c. Describe the concepts of sales management. 5d. Describe the various types of advertising media.	5.1 Concept and the process of marketing communication. 5.2 Concept of Sales promotion and its types. 5.3 Advertising media – objectives and functions, Types of media, advertising budget, functions of advertising agency. 5.4 Sales management: Concept, objectives, sales forecasting. 5.5 Personnel selling- concept, salesmanship, qualities of salesman.	08
Unit-VI **Strategic marketing**	6a. Describe the concepts of strategic marketing management. 6b. Explain the concept of Strategic marketing	6.1 Objectives and concept of strategic marketing management, 6.2 Strategic marketing Analysis-SWOT Analysis, BCG Matrix.	04
Unit-VII **International and Export marketing**	7a. Explain the concept, scope, opportunities and challenges of international marketing. 7b. Describe the Multi-National Enterprises with examples. 7c. Explain the role of Indian Trade Promotion Organization. 7d. State and explain the benefits to exporters.	7.1 Concept, scope, challenges and opportunities in international marketing. 7.2 Foreign market entry strategies. 7.3 Concept of Multi-National Enterprises (MNE) with examples. 7.4 Institutional support from government to promote export. 7.5 Role of I.T.P.O. (Indian Trade Promotion Organization) 7.6 Benefits offered to exporters by Central government.	04
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Marketing Management concept	06	08	--	14
II	Marketing Management Process	04	08	04	16
III	Price Decisions	04	04	--	08
IV	Marketing Research	04	04	04	12
V	Advertising and sales management	04	08	04	16
VI	Strategic marketing	02	04	--	06
VII	International marketing – Export	02	02	04	08
	TOTAL	**26**	**38**	**16**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Group discussion on Brand Strategies of any one company.
2. Assignment / Report writing on:
   (a) Distribution strategy of any one company.
   (b) Promotional tools (communication mix) adopted by any one company.
   (c) Comparative advertising strategies of any two companies.
   (d) Sales promotions offered by FMCG companies/brands (Minimum two companies/brands).

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Introduction to Marketing science	Lal G. K.	Pearson edition international
2	Marketing	Dale Timge	Prentice hall
3	Marketing Engineering.	Lillen Gary	Pearson edition international
4	Marketing Management	Phillip Kolter	Pearson edition international
5	Modern Marketing Management	Francis G. K.	S. Chand & Company
6	Advertising Marketing Sales Management	Thakur D.	D&D Publication
7	Marketing Management	Mr. S. A. Sherlekar	Everest Publications.
8	How to Export	NABHI	NABHI Publication

B) Software/Learning Websites

1. http://www.business-standard.com/
2. http://studymarketing.org/
3. http://salesandmarketing.com/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1				L			M	H	M	L	
CO2					H			H	H	H	
CO3			M	M	M		M	M	L		
CO4					M		H	L	M		
CO5					L		L	M	M	M	H
CO6			L	M	M	M	L	H	H	H	L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / AE
COURSE : Material Management (MMT) **COURSE CODE** : 6307

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
03	--	--	03	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

A diploma engineer has to work in different areas like Research and Design, Tool Room, Production, Production planning, Industrial Engineering, Stores, Quality Control, Marketing, Purchase.

For expressing the ideas communicating & the instructions to shop level, the knowledge of material management is essential. This course aims to avoid bottleneck due to shortage of materials and excessive inventory by quantity and number of parts, which will lead to increase in cost and ultimate loss to the industry.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the importance of raw material planning according to production requirement.
2. Identify the procedures for selecting and giving orders to the suppliers.
3. Understand the importance and procedure of inventory management.
4. Apply the various tools used for inventory management.
5. Know the procedure for purchasing material.
6. Apply the latest tools and techniques for store management.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify the types of materials and their requirements.
2. Explain the Co-ordination of material planning amongst the department.
3. Identify the different material handling equipments.
4. Enlist the duties of store officer
5. Explain the functions of production and store department.
6. Calculate the Economic Order Quantity as per requirement.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Functions of Material Management**	1a. Describe objectives of material management 1b. State functions of material management	1.1 Introduction to materials management 1.2 Objectives of material management 1.3 Functions of material management 1.4 Operating Cycle 1.5 Value analysis – Make or buy decisions.	06
Unit-II **Purchase Management**	2a. Explain functions of purchase management 2b. State the process of purchasing.	2.1 Objective, scope & Functions of purchasing department 2.2 Responsibility of purchasing section 2.3 Purchasing procedure or purchasing cycle.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	2c. Describe selection procedure of material.	2.4 Material Requisition: Material Indent form, Travelling Requisition card, Bill of material 2.5 Determining Price: Price terms, Payment terms, cost comparative statement 2.6 Calling for bids or tender or quotation: Tender, Types of tenders, Invitation to BID or An Enquiry, Evaluation of bid. 2.7 Placing purchase order formats of indent/inquiry 2.8 Selection of sources of supply 2.9 Vendor development – Vendor evaluation and rating –Imports and Buyer 2.10 Supplier relationship, Negotiations - Insurance and claims managements	
Unit-III **Stores Management**	3a. Explain the function of stores department 3b. State types of stores 3c. Describe material issue system.	1.1 Functions of stores. 1.2 Location identification 1.3 Layout of store dept. 1.4 Stock taking and materials handling 1.5 Codification of materials 1.6 Duties of storekeepers 1.7 Types of stores, storage equipments/accessories 1.8 Receipt system inward good, stock items, direct purchase items. 1.9 Material issue system 1.10 Accounts of store or store records 1.11 Valuation of Material issue from store 1.12 FIFO, LIFO. 1.13 MIS for stores management	10
Unit-IV **Inventory Management**	4a. State the various inventory costs. 4b. Explain the inventory control system. 4c. State use of OR techniques in inventory management.	4.1 Concept and definition of inventory management 4.2 Classification of Inventory 4.3 Need & function of inventory 4.4 Economic order quantity: Order quantity, Lead time, Safety stock, Re-order point. Numerical analysis. 4.5 Inventory Cost: Procurement cost, Inventory carrying cost 4.6 ABC analysis. 4.7 Inventory control system: Two Bin systems, periodic inventory order system, combinations of two bin & periodic system. 4.8 Use of computer in inventory control system. 4.9 Application of Operations Research Techniques in Materials Management for inventory.	10
Unit-V	5a. State the procedure for inspection at	5.1 Define inspection & their types, Goods receipt note	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Receiving and inspection	receipt quality store 5b. Describe quality checking and quantity checking 5c. Importance of material handling for intricate materials	5.2 Inspection at vendor's work 5.3 Quality checking and Quantity checking levels 5.4 Rejected goods replacement procedure. 5.5 Repair processes for rejected material 5.6 Material handling for intricate materials	
Unit-VI **Latest Trends in material management**	6a. Explain the importance of JIT 6b. Describe the need of SCM in industry 6c. State the need of E-material management	6.1 Concept of JIT (Just In Time) 6.2 Zero Inventory system 6.3 Introduction to supply chain 6.4 Developing supply chain to gain competitive advantage 6.5 Methods of transportation by air, rail, road, piping. 6.6 Value Stream Mapping (VSM) 6.7 KANBAN card system 6.8 E-Procurement	06
		TOTAL	**48**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Functions of material management	04	08	--	12
II	Purchase management	04	08	04	16
III	Stores management	04	08	04	16
IV	Inventory management	04	08	04	16
V	Receiving and inspection	02	06	--	08
VI	Latest trends in material management	02	10	--	12
	TOTAL	**20**	**48**	**12**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the logistics information of manufacturing, cement, pharmacy, civil, electrical industries
2. Collect and study the literature on GSCM from any industry
3. Collect and analyse the information about guidelines of material handling procedures.
4. Collect and study information of appropriate material handling devices.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show supply chain structures of different industries.
2. Arrange a visit to logistics stores or in industries from nearby areas.
3. Arrange expert seminar/lectures by a resource person from industry in the area of manufacturing, Logistics etc.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Industrial Engineering & Management	O. P. Khanna	S. Chand & Co.
2	Industrial Organisation & Management Science	Banga & Sharma	Khanna Publication
3	Materials Management	Amner Deans S.	Khanna Publication
4	Materials Management	Gopalkrishnan	Khanna Publication
5	Supply chain management. Strategy, planning & operation	Sunil Chopra	Pearson Publication

B) Software/Learning Websites

1. http://www.supplychainbrain.com/
2. http://www.legallyindia.com/
3. http://www.cipmm-icagm.ca/en/
4. http://www.iimm.org/
5. http://matmgmt.ucr.edu/

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H				M					M
CO2				M				M	H		
CO3				M		M			H		M
CO4		H		M					H		
CO5	L				M				M		M
CO6	L		H	M			M			M	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / ME / PS / EE / IF / CM / EL / AE / DD / ID
COURSE : Entrepreneurship Development (EDP) **COURSE CODE :** 6309

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. On the global scenario we have abundant physical and human resources which emphasizes the importance and need of entrepreneurship. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white- collar jobs. This course will help in developing the awareness and interest in entrepreneurship and create employment for others.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Identify entrepreneurial opportunity.
2. Develop entrepreneurial personality, skills, values and attitude.
3. Analyze business ideas- project selection.
4. Develop awareness about enterprise management.
5. Take help of support systems like banks, Government, DIC etc.
6. Prepare preliminary project report.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Develop Entrepreneurial skill by brainstorming games, SWOT analysis, Risk taking games
2. Collect information by Visiting to DIC and Nationalised Banks
3. Interview of successful entrepreneur
4. Learn the success stories from successful entrepreneur.
5. Select product after market survey for product comparison, specifications and feasibility study
6. Prepare preliminary project report

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Entrepreneurship, Creativity and Opportunities**	1a. Conduct self analysis 1b. Overview of Entrepreneurship 1c. Generating business idea	1.1 Concept, Classification & Characteristics of an Entrepreneur 1.2 Creativity and Risk taking. 1.3 Concept of Creativity, brainstorming Risk Situation, Types of risk & risk takers.	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1d. Search business opportunities	1.4 Trade Related opportunities 1.5 Business Idea -Methods and techniques to generate business idea. 1.6 Transforming Ideas in to opportunities 1.7 SWOT Analysis 1.8 Scanning Business Environment	
Unit-II **Business Terminology, Information and Support Systems**	2a. Understand Classification of business sectors 2b. Acquiring help from support systems 2c. Planning of business activities	2.1 Types of business and industries, forms of ownership, Franchisee, Export, Network/Multilevel Marketing 2.2 Sources of Information. Information related to project, support system, procedures and formalities 2.3 Support Systems ▪ Small Scale Business Planning, Requirements. ▪ Statutory Requirements and Agencies. ▪ Taxes and Acts	02
Unit-III **Market Assessment**	3a. Conducting Market survey 3b. Selection of product	3.1 Marketing - Concept and Importance 3.2 Market Identification, Survey Key components 3.3 Market Assessment	02
Unit-IV **Business Finance**	4a. Understanding terminology of finance 4b. Search and analyse sources of finance 4c. Financial ratio and profitability study	4.1 Cost of Project 4.2 Sources of Finance 4.3 Assessment of working capital 4.4 Product costing 4.5 Profitability 4.6 Break Even Analysis 4.7 Financial Ratios and Significance 4.8 Various govt. /bank schemes of finance (long term and short term)	04
Unit-V **Business Plan and Project Appraisal**	5a. Prepare a project report 5b. Conduct feasibility study	5.1 Preliminary project report preparation. 5.2 Project Appraisal & Selection Techniques • Meaning and definition • Technical, Economic feasibility • Cost benefit Analysis • Checklist	04
		TOTAL	**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Entrepreneurship Awareness- Who am I?/ EOI/ Microlab Exercise	04
2	I	Creativity Exercises/games	02
3	I	Risk taking Exercises/games	02
4	II	Brainstorming/group discussion/problem solving exercises	04
5	III	Business Games and Related Exercises	04
6	II	Interview of an entrepreneur	02
7	IV	Event/task/activity management-group of 4-6 students will work together	04
		AND/OR	
1 to 7	I-IV	3 day Achievement Motivation Training workshop /Entrepreneurship Awareness Program	22
8	V	Visit to DIC/Bank/MSSIDC/MIDC/MPCB/Industry	04
9	V	Prepare a preliminary project report and study its feasibility	06
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Assess yourself – are you an entrepreneur? (Self Analysis)
2. Report on
   - interview of successful entrepreneurs (minimum two)
   - interaction with the support systems
   - visit to small scale industry
3. Product survey - select one product and collect all its related information i.e. specification, price, manufacturer from at least three suppliers/ manufacturers
4. Prepare list of identified opportunities

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Conduct 3 days awareness camp for entrepreneurship by professional bodies
2. Arrange a visit to SSI/DIC
3. Arrange Interview / Expert lecture of an entrepreneur

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Entrepreneurship Development	E. Gorden K. Natrajan	Himalaya Publishing, Mumbai
2	Entrepreneurship Development	Colombo plan staff college	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
3	A Manual on How to Prepare a Project Report	J. B. Patel D. G. Allampally	EDI STUDY MATERIAL Ahmadabad
4	A Manual on Business Opportunity Identification & Selection	J. B. Patel S. S. Modi	
5	National Directory of Entrepreneur Motivator & Resource Persons.	S. B. Sareen H. Anil Kumar	
6	A Handbook of New Entrepreneurs	P. C. Jain	
7	The Seven Business Crisis & How	V. G. Patel	

Sr.No.	Title of Book	Author	Publication
	to Beat Them.		
8	Entrepreneurship Development of Small Business Enterprises	Poornima M. Charantimath	Pearson Education, New Delhi
9	Entrepreneurship Development	Vasant Desai	Himalaya Publishing, Mumbai
10	Entrepreneurship Theory and Practice	J. S. Saini B. S. Rathore	Wheeler Publisher, New Delhi
11	Entrepreneurship Development	--	TTTI, Bhopal / Chandigarh
12	Entrepreneurship Management	Aruna Kaulgad	Vikas Publication

B) Software/Learning Websites

Websites-

1. http://www.ediindia.ac.in
2. http://www.dcmsme.gov.in/
3. http://www.udyogaadhaar.gov.in
4. www.smallindustryindia.com
5. www.sidbi.com
6. www.tifac.org.in

C) Video Cassettes /CDs

Sr.No.	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat, Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428, Gujarat, India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in olpe@ediindia.org Website : http://www.ediindia.org
2	Assessing Entrepreneurial Competencies	
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur skill	
6	Chhoo Lenge Aasman	
7	Creativity	

D) Major Equipments/ Instruments with Broad Specifications

Not applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1			L				L	M			M
CO2					M		M	H	M	M	H
CO3					L		M	L	H	L	M
CO4					L	M	M	M	M	H	M
CO5					H	M	M	H	H	M	M
CO6	L	M	M	M	M	M	H	H	M	H	H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in CE / PS / EE / EL / AE
COURSE : Renewable Energy Sources (RES) **COURSE CODE** : 6310

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

Modern society relies on stable, readily available energy supplies. Renewable energy is an increasingly important component of the new energy mix. The course covers energy conversion, utilization and storage for renewable technologies such as wind, solar, biomass, fuel cells and hybrid systems. Thermodynamics concepts (including the first and second law) form the basis for modelling the renewable energy systems. The course also touches the environmental consequences of energy conversion and how renewable energy can reduce air pollution and global climate change.

2.0 COURSE OBJECTIVES:

The student will be able to

1. List various sources of energy and their applications in India and around the world.
2. Describe the challenges and problems associated with the use of various energy sources, with regard to future supply and the environment.
3. Determine potential solutions to the supply and environmental issues associated with energy sources.
4. Understand Emerging Energy Technologies.
5. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

3.0 COURSE OUTCOMES:

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

1. Enlist various energy sources and state their present scenario in India
2. State the solar energy applications and functions of system components.
3. Apply the basics of wind and ocean energy for electricity generation.
4. Describe the conversion process of biomass energy.
5. State and apply the various Emerging Energy Technologies

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Energy Science and Sources**	1a. Define energy conservation law 1b. Identify various sources of energy and compare them. 1c. Understand the present energy situations and schemes for renewable energy promotion.	1.1 Concept of energy, Law of conservation of energy 1.2 Introduction to conventional energy sources and renewable energy sources 1.3 Comparison between energy sources 1.4 Present scenario in energy crises in India and world 1.5 Government schemes to promote use of renewable energy sources	02

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Solar Energy**	2a. Define the basic conversation principle of solar energy. 2b. Describe the solar system used in water heating. 2c. State the applications of solar energy	2.1 Introduction to solar energy 2.2 Physical principles of conversion of solar radiation into heat 2.3 Flat plate collectors and concentric collectors 2.4 Solar energy storage system 2.5 Applications of solar energy in Water heating, Space heating and cooling, Greenhouses and electricity generation	04
Unit-III **Wind and Oceans Energy**	3a. Understand the concept of electrical wind generation. 3b. State basic components of WECS. 3c. Distinguish Wind and Oceans Energy 3d. Explain ocean thermal electric power generation 3e. Describe the principle of tidal power generation.	3.1 Basic principles of wind energy conversion 3.2 Site selection considerations 3.3 Basic components of a wind energy conversion system (WECS). 3.4 Advantages and disadvantages of WECS. 3.5 Applications of Wind energy. 3.6 Introduction of Oceans energy 3.7 Methods of ocean thermal electric power generation 3.8 Open cycle and closed cycle Ocean thermal energy conversion (OTEC) system 3.9 Basic principle of tidal power	05
Unit-IV **Bio mass Energy**	4a. State resources of Biomass energy. 4b. Describe the biomass conversion process. 4c. Know Bio Diesel and Bio Mass plant 4d. State information of Government schemes to promote use of biomass energy.	4.1 Introduction to biomass energy 4.2 Biomass energy resources 4.3 Biomass conversion process : Direct combustion, thermo chemical conversion, bio chemical conversion 4.4 Introduction to bio gas plant 4.5 Introduction to Bio Diesel, Bio Mass plant 4.6 Government schemes to promote use of biomass energy	03
Unit-V **Emerging Energy Technologies**	5a. Define the Hydrogen Energy. 5b. Describe properties of hydrogen and its sources. 5c. Know the hydrogen handling.	5.1 Hydrogen Energy 5.2 Properties of hydrogen 5.3 Hydrogen as source of renewable energy 5.4 Sources of hydrogen 5.5 Production of hydrogen 5.6 Storage and transportation 5.7 Introduction to Carbon Capture and Storage (CCS)	02
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

A. SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Group discussion on benefits of renewable energy sources.	02
2	II	Visit solar water heating system demonstrate and write report on demonstration of solar water heater	04
3	II	Report on demonstration of solar light with the connection diagram.	04
4	II	Visit to the solar power plant write report and draw layout of solar power plant.	06
5	III	Visit to the wind power plant write report and draw a layout of Wind power plant	06
6	IV	Report on demonstration of bio mass gasifier	04
7	IV	Case study of Bio gas plant and tidal power plant	04
8	V	Group discussion on Emerging Energy Technologies and their future	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect renewable energy information from web source.
2. Collect and analyse information from web site of BEE (Bureau of Energy Efficiency) and MEDA (Maharashtra Energy Development Agency) on energy.
3. Prepare a report on Government schemes to promote use of renewable energy sources.
4. Identify and collect different manufactures of solar water heater.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration of solar water heater system.
2. Visit to solar plant to understand the working of solar generation.
3. Arrange expert lectures on new trends in renewable energy.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Renewable energy sources and conversion technology	Bansal Keemann, Meliss,	Tata McGraw Hill
2	Renewable energy resources and emerging technologies	Kothari D. P.	Prentice Hall of India Pvt. Ltd.
3	Non-Conventional energy Sources	Rai G. D.	Prentice Hall of India Pvt. Ltd.
4	Nonconventional Energy	Ashok V. Desai	New Age International Publishers Ltd

B) Learning Websites

1. Website of bureau of energy and efficiency: www.bee-india.nic.in
2. www.betterenergy.org
3. www.mahaurja.com Maharashtra Energy Development Agency (MEDA):
4. www.worldenergy.org
5. www.renewableenergyworld.com

C) Major Equipments/ Instruments with Broad Specifications

1. Solar water heating system
2. Solar lighting system

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		M			L	H					
CO2			H								M
CO3		M				H					
CO4			H								
CO5					M	H					

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Safety (ESY) **COURSE CODE** : 6314

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
01	--	02	03	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	10	--

1.0 RATIONALE:

Electrical hazard is a measure threat to the human life. To overcome this electrical technician must know, understand and implement various techniques of electrical safety.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the importance of electrical safety
2. Understand the effect of electrical hazards on human body
3. Understand the methods and procedure to avoid electrical hazards
4. Understand the methods to rescue a person from electrical hazards

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Understand different I.E. rules related to electrical safety
2. Understand different preventive methods for avoiding electrical hazards
3. Understand use of locks and tags
4. Classify fires
5. Compare different fire extinguishers
6. Apply different methods of resuscitation

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **General Safety Precautions and Hazards Of Electricity**	1a. Describe the safety precautions to be followed 1b.Describe the electrical hazards	1.1 General safety precautions and related IE Rules 1.2 Apparel of person working on an electric panel/installation. 1.3 Precautions to be taken while working on an electrical installation 1.4 Hazards of electricity Shocks direct or indirect. ▪ Burns ▪ Arc-Blast ▪ Thermal Radiation ▪ Pressure Wave ▪ Projectiles ▪ Explosions ▪ Fires	08
Unit-II **Safety Procedures**	2a. Describe the safety methods 2b. Describe the firefighting	2.1 Six step safety method 2.2 Lockout-Tagout : rules for using locks and tags 2.3 Barriers and warning signs	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
and Methods	techniques 2c. Describe the methods of resuscitation	2.4 Classification of fire extinguishers 2.5 Working of most common types of fire extinguishers (APW, Dry chemical, CO2) 2.6 Artificial Respiration 2.7 Electrical Rescue Techniques	
TOTAL			**16**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	II	Demonstration of different fire extinguishers	04
2	II	Demonstration of different methods of artificial respiration	06
3	II	Visit to nearby fire and safety institute	08
4	II	Visit to a medium scale industry for understanding electrical safety practices and collection of different formats in the industry regarding accident.	08
5		Case study on electrical accident in electrical network	06
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Dismantle and reassemble other single phase motors.
2. Reversing direction of rotation of single phase induction motor
3. Visit small water pump, mixer, domestic appliances rewinding shop

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electrical safety Handbook Machines	John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Al winfield	McGraw Hill

B) Software/Learning Websites

1. google images for electrical safety
2. www.electricalsafetyfirst.org.uk/
3. http://www.osha.gov/dte/grant_materials/fy09/sh.../electrical_safety_manual.pdf
4. www.labtrain.noaa.gov/osha600/refer/menu12a.pdf

C) Major Equipments/ Instruments with Broad Specifications

1. First aid box
2. Fire extinguishers

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H			L	M					
CO2			H		L						
CO3				H		M					
CO4		H				M					
CO5				H		M					
CO6					H						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Professional Practices (PPR) **COURSE CODE** : 6410

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONAL :

Most of the student joins industries, due to globalization and competition in the individual & service sector the selection for the job is based on campus interviews or competitive tests while selecting a candidate a normal practice adopted is to see general confidence ability to communicate in addition technological concepts and developments. The purpose of inducing this course is to provide opportunity to student to undergo activities which will enable them to develop confidence, industrial visits, expert lectures etc. are the topic of course so that they can interact with the industry

2.0 COURSE OBJECTIVES:

The student will be able to

1. Acquire the information from different sources
2. Interact with peers to share thoughts
3. Familiarize with the industrial environment.
4. Know the recent trends /practices in electrical engineering.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Prepare report on Industrial/ Government organization.
2. Update the technological knowledge observed in the industry.
3. Learn the technological changes through expert lecture.
4. Interact effectively on various topics.
5. Effective use of media for the required technical information.
6. Search, relate and use information.

4.0 COURSE DETAILS:

Note: There are no separate classes for theory as given below. The relevant theory has to be discussed before the practical during the practical sessions.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-I **Information Search**	1a. Search information on given topic using effective media 1b. Relate and use information as per need. 1c. Present the information as per demand/ need	Student should search information on small topics such as 1.1 Documentation for getting power supply for L.T. & H. T. Consumers 1.2 Electrical item procurement & Taxation 1.3 Alternative fuel and energy topics 1.4 Electrically operated motor cars, bikes etc. 1.5 Magnetic levitated system 1.6 How to write CV/ resume (CV Writing). 1.7 Procedure for filling a Tender & Contract document.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		1.8 Electrical safety regulation 2010
Unit-II **Industrial Visit**	2a. Know organizational chart of LSI/SSI/Government undertaking organisations 2b. Draw layout of plant/substation 2c. Understand the working of Industry 2d. Write report on visit	Structured industrial visit is arranged and report of the same should be submitted by the individual student to form part of the term work Visit of any 4 of the following 2.1 Construction site for residential/Public building for electrical installation 2.2 Transmission/Distribution substation 2.3 Small scale manufacturing industry like choke/ small transformer etc 2.4 Domestic appliances repair center 2.5 Visit to electronic industry, Switchgear Industry. 2.6 Visit to electronic/ electrical meter manufacturing industry 2.7 Visit to generating station 2.8 Visit to foundry to observe furnaces and ovens. 2.9 Visit to traction machine workshop 2.10 Visit to Indian Railway Institute of Electrical Engineering Nashik (IRIEEN) 2.11 Visit to an industry implementing automation in the manufacturing process and any other visit related to electrical engineering curriculum
Unit-III **Expert Lectures**	3a. State recent trends in electrical Engineering 3b. Understand the importance of professional ethics 3c. Share the success story of the expert to choose the carrier path	Lecture by professionals / Industrial expert to be organized on any two topics of the following suggested areas or any other suitable topics. 3.1 Fire hazards due to short circuits 3.2 Effects of transmission & distribution losses 3.3 Electrical safety in industry 3.4 Modern trends in AC machines & equipments 3.5 Testing of switchgears 3.6 Interview Techniques 3.7 New trends in power electronics devices 3.8 TQM 3.9 Recent modifications in I. E. rules 3.10 Green Technology 3.11 Tariffs
Unit-IV **Brain Storming Sessions/ Group Discussions**	4a. Discuss on recent topics 4b. Participate and lead discussion 4c. Summarize the topic of discussion 4d. Familiar with the pros and cons of the topic.	The students should discuss in group of six to eight & write a brief report on the same as a part of term work. Topic for group discussion may be selected by faculty member. Some of the topics are 4.1 Current topics related to electrical engineering field 4.2 Load shedding & remedial measures. 4.3 Trends in energy conversion 4.4 Disaster management 4.5 Energy saving in the institute 4.6 Safety in day to day life

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Not Applicable

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1		**Information search, data collection and writing a report on the topic (Any Five)** a. Collection of sample format and documents required for getting L.T. and H.T. power supply. b. Preparing proposal for material procurement for a residential/ commercial /Industrial installations (includes specification catalogues with price, manufacturer suppliers List) c. Collection of alternative fuel sources d. Market survey of electrically operated vehicles. e. Search the information of magnetically levitated locomotives. f. Write down own resume g. Collection of sample tender notices from web source and news papers, Prepare a sample tender notice for electrical installation work.	24
2		**Industrial visits (Any Two)** a. Residential/commercial building electrical installation site Visit b. Transmission/Distribution substation c. Small scale manufacturing industry like choke/ small transformer etc d. Domestic appliances repair center e. Visit to electronic industry, Switchgear Industry. f. Visit to electronic/ electrical meter manufacturing industry g. Visit to generating station h. Visit to foundry to observe furnaces and ovens. i. Visit to traction machine workshop j. Visit to Indian Railway Institute of k. Electrical Engineering Nashik(IRIEEN) l. Visit to an industry implementing automation in the manufacturing process	16
3		**Expert Lectures (Any Two)** The lectures from professionals/ industry expert to be organized (2 hrs. duration) on any 2 topics of following suggested areas or any other suitable topics. a. Fire hazards due to short circuits b. Effects of transmission & distribution losses c. Electrical safety in industry d. Modern trends in AC machines & equipments e. Testing of switchgears f. Interview Techniques g. New trends in power electronics devices h. TQM	08

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
		i. Recent modifications in I. E. rules j. Smart Grid/ city k. Demand side management	
4		The students should discuss in group of six to eight. Some of the topics are a. Current topics related to electrical engineering field b. Load shedding & remedial measures. c. Trends in energy conversion d. Disaster management e. Energy saving in the institute f. Safety in day to day life	16
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Industrial visit /Field visit
2. Expert lectures
3. Prepare report on above
4. Information search on various topics
5. Make presentation on given topic

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If

1. Arrange a visit/field visit
2. Arrange expert Lectures of industry person /expert on latest trends /practices
3. Show documentary /

9.0 LEARNING RESOURCES:

A) National and international Journals and Magazine. Electronics for you, Electrical India, Electrical Power

B) Software/Learning Websites

1. http://www.nrel.gov/
2. www.icrepq.com
3. www.nptel.ac.in
4. http://www.smartgrid.gov
5. smartgrid.ieee.org

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1										H	
CO2											H
CO3					M						H
CO4		L							H		
CO5		L							H		
CO6		H			L					L	

H: High Relationship M: Medium Relationship L: Low Relationship

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Seminar (SEM) **COURSE CODE :** 6411

Teaching & Examination Scheme:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	02	02	--	Max.	--	--	--	--	--	50	50
					Min.	--	--	--	--	--	20	--

1.0 RATIONALE:

An engineer or technician has to carry out variety of tasks & face problems and situations in his Professional life. He has to convey his ideas, communicate with people. Effective presentation of ideas, thoughts and information becomes a requisite skill for him.

The involvement of student in the seminar course will help him to plan and prepare the related topic by searching information from various sources, interact with others, analyze the information, document the content and present.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Develop abilities to search information
2. Suggest ideas through seminar
3. Collect data, information from various resources
4. Develop planning of seminar activities
5. Develop skill to communicate the problems and solutions
6. Develop skill to prepare reports
7. Develop presentation skills

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes as applicable to seminar:

1. Know and select seminar topic or problem statement in engineering field
2. Draft Problem statement or topic of seminar
3. Carry out literature survey from various resources
4. Write review of information search
5. Develop document preparation skills
6. Use of presentation skill for seminar delivery
7. Keep updated with latest trends in areas of engineering discipline

4.0 COURSE DETAILS:

Activity No	Activities
1	Briefing about selection for seminar topics in class: Discussion in class
2	Search seminar topics and approval of topic from guide from searched topics.
3	Collection of data and literature for seminar from: internet/ visit/Journals/Books/EBooks
4	Preparation of synopsis of seminar topic: print draft copy
5	Submission of seminar synopsis to guide (Printed copy)
6	Guidance about preparation of document by guide
7	Preparation of document by students
8	Editing document
9	Submission of Seminar and presentation document: Hard copy & Soft copy of power point
10	Submission of diary
11	Seminar Presentation

The activities mentioned above shall be monitored and guided by the guide every week during the contact hours provided for the same.

5.0 AREAS FOR SELECTION OF SEMINAR:

Sr.No.	Areas For Selection
1	Modern traction systems
2	Power system recent developments
3	Power quality
4	EHV & HVDC Transmission
5	Energy efficient machines/ New Trends in Machines/Electric Drives
6	New trends in switchgear
7	Energy conservation
8	Renewable energy
9	Energy Audit
10	Automation and Control of drives
11	Any other topic related to electrical engineering

6.0 SUGGESTED INSTRUCTIONAL STRATEGIES:

Classroom Teaching, Library Assignment, Group Discussion, Case Studies

7.0 LEARNING RESOURCES:

Magazines, Journals, Papers: National & international Reference Books, Internet, Previous seminars, Text Books, Codes of Practices e. g. IS Codes, Video Cassettes, Audio Cassettes, Compact Discs, Charts, Transparencies, Software, Models, Industrial visits, expert lectures/workshops

8.0 GUIDELINES FOR SEMINAR:

1. **Selection of topic for seminar:**
   a. The student shall search from various resources and get the topic approved.
   b. Topic of seminar shall be based on curriculum with new developments.
   c. Topic of seminar should not be from the project taken by the group or by individual.
   d. Selection of topic should be finalised in consultation with teacher guide allotted for the seminar.

2. **Submission of Seminar Document:**
   a. The student shall get the seminar draft approved from Guide and complete final document.
   b. Each student shall prepare two hard copies of final seminar document and retain one copy with student and submit one hard copy along with soft copy for department.
   c. The structure of the seminar document shall be as per the following format: Certificate / Acknowledgement / Index / Introduction / Detailed content / Conclusion / References.
   d. The seminar report shall be of minimum 10 pages and Max. 20 pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2 cm, bottom margin 2 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified. It should be certified by seminar Guide and Head of department.

3. Evaluation of Seminar:

Evaluation of seminar will consist of Progressive Assessment, Presentation

i. Progressing Assessment:

1. Progressive assessment will be based on attendance, searching of various seminar topics, selection of title, collection of data from internet, Journals, Literatures, organization of data and preparation of document.
2. The student has to get seminar document assessed from guide regularly.
3. The attendance of the student shall carry 05 marks as follows
   a. Below 75 % : 00 marks
   b. 75 % and below 80 % : 02 marks
   c. 80 % and below 85 % : 03 marks
   d. 85 % and below 90 % : 04 marks
   e. 90 % and above : 05 marks

ii. Presentation of Seminar:

1. The time for presentation shall be 7 to 10 minutes per student
2. The question answer session time shall be 2 to 3 minutes per student
3. Evaluation of presentation of seminar will be carried out by a panel of teaching staff from institute based on the following point
   a. Confidence and courage
   b. Technical Knowledge acquired
   c. Presentation skill
   d. Use of presentation medium e.g. A/V aids, animation

iii. Marking scheme for Seminar.

Progressive assessment	Confidence and courage	Technical knowledge	Presentation skill	Use of media	Total
25	05	05	10	05	50

9.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1								H			
CO2								M		H	
CO3		H						M			
CO4			H		M					L	
CO5									H	M	
CO6											
CO7											H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Project (PRO) **COURSE CODE** : 6412

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
--	--	04	04	--	Max.	--	--	--	--	50	50*	100
					Min.	--	--	--	--	20	20	--

* Indicates TW to be assessed by external & internal examiners.

1.0 RATIONALE:

An Engineer or technician has to work on various projects in profession or field work. The aim of project is to develop the ability of "learning to learn' on its own, work in team. This would go a long way helping the students in keeping pace with future changes in technology and acquisition of Knowledge and skills as and when needed.

The scientific way of solving the problems and ability to apply it to find alternative solutions for the problems will help a technician in his professional life. This course will help to inculcate leadership skills, decision making, participative learning, resource management, cost considerations, documentation and report writing skills with effective communication.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Integrate the knowledge of engineering programme
2. Develop the skill to identify the problem & define the problem statement
3. Develop scientific attitude for stepwise solutions to the problems
4. Develop attitude to work in team and act as leader of project
5. Develop planning & execution skills
6. Build multidisciplinary concept with cost considerations
7. Understand recent developments in engineering fields and prepare report

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate some of course outcomes as applicable to project:

1. Participate effectively in group work
2. Collect, analyse and synthesise the data
3. Conduct a survey and investigate the activities
4. Make appropriate decision
5. Act as leader for group task
6. Develop cost consideration
7. Prepare technical reports

4.0 COURSE DETAILS:

Activity No	Activities
1	Formation of Group
2	Selection of Project: Individual/Group discussions
3	Define Problem statement for project work
5	Decide Strategies/Methodology to carry out project
6	Literature Survey/data survey
7	Submission of synopsis: by each group
8	Project activity plan-Defining activities, strategy, duration
9	Allocation of work responsibility to individual/team
10	Visits to Industries / Institutions / Market/field work/sites
11	Collection of Data /Survey/Analysis

Activity No	Activities
12	Design of Components, preparation of drawing, estimates wherever required, printed circuits design, its checking,
13	Fabrication, Assembling, Model/Prototype development, Testing as per project requirements
14	Progressive presentation of work and recording in diary
15	Consolidation of work allotted to individual or team
16	Presentation of initial draft: pre submission draft
17	Final Project Report: Printed: Submission: soft & Hard copy
18	Group presentation of project work at the time of final evaluation

The activities mentioned above shall be monitored and guided by Project Guide every week during the contact hours provided for the same.

The Project is also included with Seminar with the aim to develop certain set communication skills (preparation of report, writing survey report writing Lab. experiment results writing conclusions of the work done and physical phenomenon observed, participating in group discussions, verbally defending the project in the form of Seminar etc.)

5.0 AREA OF SELECTION FOR PROJECT

These are only guidelines; any project related to Electrical Engineering depending upon the availability of projects may be included. Preference should be given to practical oriented projects according to the local needs.

Sr.No.	Areas For Selection
1	Illumination Engineering
2	Green building Codes,
3	Hybrid Vehicles
4	Variable Voltage Variable frequency drives
5	Traction new trends
6	EHV Transmission
7	Smart Grid Applications
8	Computer application in design of Electrical Machines
9	Energy Conservation, Energy Audits
10	Smart Metering, Electricity Theft Reduction
11	Power Quality
12	Renewable Energy
13	Any other topics related to Electrical Engineering

6.0 GUIDELINES FOR PROJECT:

A. Group Formation:

1. The department Head / Officer in Charge shall make sure that the project groups are formed within **one week** of the beginning of academic term and assign a faculty as project guide.
2. The students may be asked to work in groups of five students. The group size may be varied in accordance with the effective compliance of project work.
3. The group can decide the leader and distribute work and prepare the group management structure.

B. Finalization of Project Title:

1. The students are expected to take up a project with the guidance of a Project Guide from the institute/Industry Expert/Sponsored by industry, Institute, society, self.
2. Industrial project shall be encouraged.
3. The students can seek help from TPO/ HOD/Guide.

4. The group of students/Project guide/authority shall see the viability/ feasibility of project over the duration available with the students and capabilities and setup available.

C. Note:

1. The group / student shall prepare Project Diary with Name of Project, Name of Students in group, their attendance and progress and get assessed from guide from time to time during project hours.
2. The title of the project should be finalized within **two weeks** after the group formation and a synopsis of the project should be submitted to the guide.
3. An abstract (synopsis) not exceeding 100 words, indicating salient features of the work shall be submitted to guide.
4. Modify format suitably as per requirement of the project.

D. Project Execution:

1. Guide shall monitor the work and help the students from time to time.
2. The progress shall be presented before the guide every week during project hours.
3. The students shall design parts, prepare their drawing showing all details and manufacture within the institute / sponsoring industry / workshop in local areas.
4. The guide should maintain a record of progressive / continuous assessment of project work and observe the progress of each group member on weekly basis.
5. The same shall be kept ready for submission to the external examiner before the final examination.

E. Evaluation of Project:

1. The continuous evaluation of individual progress shall be followed
2. External examiner and guide shall jointly evaluate the project.
3. The project can be evaluated on site if it is difficult to bring or demonstrate the trials in the institute
4. The attendance of the student shall carry 05 marks as follows
   i. Below 75 % : 00 marks
   ii. 75 % and below 80 % : 02 marks
   iii. 80 % and below 85 % : 03 marks
   iv. 85 % and below 90 % : 04 marks
   v. 90 % and above : 05 marks
5. The details of project assessment are mentioned in Annexure II

F. Project Report:

1. The student shall get the initial draft copy of the project approved from the Project Guide.

2. Structure: It shall be as follows

   - Title page, Inner title page (white), Certificate, Certificate from Industry, Synopsis, Acknowledgment, Table of Contents, List of table & figures (optional), Introduction, Objectives of the Project, Methodology used, Design, Drawing of the part and assembly, Testing, Costing, Result, Conclusions & Scope for future, Merits, Demerits, Applications, Bibliography
   - Annexure consists of various designed parts and assembly drawings, photographs, charts, statistical data
   - CD of video clips /Power Point presentation

3. Each group has to submit one copy of project report to the library and one soft and hard copy to the department apart from the individual copy.

4. The project report will be of 40 to 50, A4 Size pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2.5 cm, bottom margin 1.5 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified.
5. Chapters (to be numbered in Arabic) containing Introduction-which usually specifies scope of work and the present developments. Main body of the report divided appropriately into chapters, sections and subsections. The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc. and subsections as 2.2.3, 2.5.1 etc.
6. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.
7. The figures and tables must be numbered chapter wise.
8. The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.
9. Reference OR Bibliography:
   The references should be numbered serially in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [4]. The section on references should list them in serial order in the following format.
   a. For textbooks – Dr. V.L. Shah & Veena Gore, Limit State Design of Steel Structures, Structures Publications, 1 Edition, 2009.
   b. For papers - David, Insulation design to combat pollution problem, Proc of IEEE, PAS, Vol 71, Aug 1981, pp 1901-1907.
   c. Only SI units are to be used in the report. Important equations must be numbered in decimal form.
   d. All equation numbers should be right justified.
10. Each student from group shall have one copy with individual certificate only.
11. The project report and progressive assessment sheets are to be submitted before the end of term declared in the Academic Calendar of the institute.

7.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	H										
CO2		H									
CO3							M				
CO4	M					L					
CO5				L			M				
CO6			H				H				
CO7			H								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Installation System(EIS) **COURSE CODE :** 6426

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Electrical diploma holders have to work as technicians and supervisors on various types of electrical Installations. Electrical Installations differ from each other in respect of their size, capacity, construction and application also. It is necessary for them to understand the practices, procedures followed for designing installations in addition to theoretical aspects required. All these points are taken care of including introductory knowledge of E-tender and contracts.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Classify different types of electrical Installations.
2. Draw and Interpret wiring diagrams.
3. Know I. E. rules related to electrical installations and safety
4. Design in detail wiring installations of residential and commercial units.
5. Design motor installations in small industry/workshops.
6. Carry out load survey and determine transformer capacity in area electrification
7. Understand the concepts of contracts and E- tender.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Prepare detail estimate and costing of Residential and commercial wiring installation.
2. Prepare detail estimate and costing for wiring of motor installation in small industry / workshop.
3. Select the suitable wiring system and accessories according to workplace.
4. Design illumination / Lighting scheme for indoor premises.
5. Determine the transformer capacity in an Area Electrification project.
6. Prepare contract and tender documents.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Installation Component and Wiring Systems**	1a. Identify different types of Light fittings and wiring accessories. 1b. Explain supply distribution and methods of wiring. 1c. Draw wiring diagrams in different ways for controlling Lamp and fan.	1.1 Different type of switches &, different types of light fittings 1.2 Size of wire & different types of wires 1.3 Systems of distribution of electrical energy: Distribution board system 1.4 Methods of wiring: Loop in system 1.5 Different wiring systems 1.6 Comparison between systems of wiring 1.7 Simple lamp & fan circuit: Single line diagram & wiring diagram of following- ▪ One lamp Control by one switch, Master ON &OFF circuit	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		▪ Stair case wiring, corridor wiring, ▪ Go-down wiring.	
Unit-II **Lights, Lighting Schemes and Design Of Illumination Scheme**	2a. Explain construction and Working of different types of lamps. 2b. Define basic terms related to illumination. 2c. State laws of illumination. 2d. Explain Factors affecting on quality of lighting system. 2e. Solve numerical based on design of lighting scheme. 2f. Explain street lighting, Factory lighting and flood Lighting.	2.1 Different types of Lamp: Construction, Working and Applications of Incandescent lamp, Gaseous discharge lamp - fluorescent tube, T5, sodium vapour lamp, HP mercury vapour lamp, CFL, Metal Halide lamp, LED lamp, 2.2 Definition & unit of Different terms such as: Luminous flux, Lumen, candela, illumination, luminance, brightness, Lux, CRI, Efficacy Laws of illumination 2.3 Internal lighting Schemes: Direct, indirect lighting, semi direct, semi indirect lighting. 2.4 Factors affecting on quality of lighting system 2.5 Design of lighting scheme: - a. Factors considered while designing such as –Space height ratio, utilization factor, depreciation factor, waste light factor b. Numerical on design of lighting scheme. 2.6 Flood lighting, factory lighting and Street lighting.	12
Unit-III **Domestic and Commercial Wiring Installation**	3a. Prepare Estimate for installing underground and overhead service connection 3b. Draw main board details of domestic consumer. 3c. State general rules and guidelines for wiring in residential and commercial wiring installation 3d. Select the proper rating switchgears for residential and commercial wiring installation. 3e. Prepare Layout and wiring diagram for residential and commercial wiring installation. 3f. Calculate the Load, quantity and cost of	3.1 Concept of service line connection & I. E. rule No 58, 77 and 79 3.2 Methods of Installation of service connection: underground & overhead 3.3 Estimates of underground & overhead service connection. 3.4 Main board details of domestic consumer 3.5 General rules, guidelines for wiring of residential Installation & positioning of equipments 3.6 Procedure for designing the circuit & deciding number of sub circuits (L&F sub circuit, Power sub circuit) 3.7 Layout of domestic wiring 3.8 Load assessment & selection of size of conductor, rating of main switch, distribution board, protective switchgear (ELCB &MCB) & all wring accessories 3.9 Sequence to be followed in carrying out the estimate 3.10 Preparation of schedule of material required & costing of residential installation	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	material required for domestic wiring 3g. Differentiate between Residential & Commercial Installation.	3.11 Differentiate between Residential & Commercial Installation 3.12 Fundamental design considerations of Electrical Installation system for commercial building 3.13 General rules, guidelines for wiring of commercial Installation & position of equipments 3.14 Deciding the number of sub circuits, Load Calculation, size of conductor & switchgears 3.15 Preparation of detailed estimate & costing of commercial Installation 3.16 I E rules related to Safety (Numerical on above)	
Unit-IV **Electrical Installation In Small Industries**	4a. State important Consideration regarding motor installation wiring. 4b. Prepare Layout and wiring diagram for motor installation in small industry/ workshop 4c. Select the proper rating switchgears for motor Installation wiring 4d. Calculate quantity and cost of material required for motor installation wiring in industry.	4.1 Concept of industrial load 4.2 Important design consideration regarding motor installation wiring 4.3 Layout of motor installation wiring 4.4 Determination of power and input current & starting current of motors 4.5 Determination of rating of cables, fuses/MCB size of conduit, ICDB, main switch, starter 4.6 Preparation of detailed estimate & costing of small industries /workshop	12
Unit-V **Area Electrification**	5a. Describe methods of load forecasting 5b. State different types of electrical consumer 5c. List steps followed for designing area electrification project. 5d. Determine transformer capacity in an area electrification project.	5.1 Important terms required for load prediction 5.2 Methods of Load forecasting 5.3 Types of electrical consumer 5.4 Steps followed for designing area electrification project 5.5 Determination of transformer capacity of an area (Numerical on above)	08
Unit-VI **Contracts and Tenders**	6a. Explain the concept of contracts and E tender 6b. Explain the types of contract List down	6.1 Concept of contracts 6.2 Requirements of contracts, contract documents 6.3 Types of Engineering contract- ▪ Item Rate contract	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	tender documents 6c. Describe the procedure for submission and opening of E - tender.	▪ DGS & D rate contract ▪ Percentage rate contract Labour Contract, Material supply contract, Turn Key job contract 6.4 Concept of E tender 6.5 Tender documents 6.6 Tender Notice 6.7 E- Tendering procedure 6.8 Comparative statement	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Installation components and wiring systems:	02	04	04	10
II	Lights, lighting schemes & design of illumination scheme	04	04	04	12
III	Domestic& commercial wiring Installation	04	04	12	20
IV	Electrical Installation in small Industries	02	04	10	16
V	Area Electrification	-	04	06	10
VI	Contracts & Tenders	04	08	-	12
	TOTAL	**16**	**28**	**36**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Drawing Exercises	Hours
1	I	Draw sheet on circuit diagrams for various lamps and fans controlling circuit like Staircase and Go-down wiring, Distribution system,	08
2	IV	Draw a sheet on different types of Earthing	08
3	III	Design electrical installation scheme for Flat/Independent bunglow / House: Draw Installation plan, single line diagram & wiring diagram Prepare material schedule & detailed estimate & costing	08
4	III	Design and draw wiring diagram for residential installation by using Inverter as backup supply.	08
5	III	Design electrical Installation scheme for any one commercial	08

Sr. No.	Unit No.	Drawing Exercises	Hours
		complex/Hospital/Drawing hall: Draw Installation plan, single line diagram & wiring diagram. Prepare material schedule & detailed estimate & costing	
6	IV	Design Electrical Installation scheme for agriculture pump room /Floor mill: Draw Installation plan, single line diagram & wiring diagram. Prepare material schedule & detailed estimate & costing	08
7	IV	Design electrical Installation scheme for small unit/workshop/Machine Lab: Draw Installation plan, single line diagram & wiring diagram. Prepare material schedule & detailed estimate & costing	08
8	V	Draw Panel Wiring of the electrical laboratory / institute /control panel of electrical equipments.	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Case study on area electrification /colony/small village/institute
2. Survey and Collect wiring material and modern switch boards leaflets.
3. Checks sample bills of contractors for payment of a work by referring schedule of rates described by electricity authorities.
4. Survey and collect rates for various items of works.
5. Gather Electrical work tender notices from news paper/internet and read and interpret it.
6. Collection of list of manufacturer of various wiring/Installation accessories

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Site visit on residential/commercial Installation and prepare report

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electrical Estimating & costing	Surjit Singh	Dhanpat Rai & sons
2	Electrical Installation, estimating & Costing	J. B. Gupta	Dhanpat Rai & sons
3	Electrical Design, Estimating & costing	K. B. Raina S. K. Bhattacharya	New age International Ltd, New Delhi
4	Electrical wiring, Estimating & costing	S. L. Uppal	Khanna Publisher
5	Electrical wiring, Estimating & costing	B. D. Arora	R. B. Publications New Delhi

B) Software/Learning Websites

1. www.howstuffworks.com
2. www.nptel.iitm.ac.in
3. www.philips.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H			M						
CO2		H			M						
CO3		H			L						
CO4			H		M						
CO5					H						
CO6		H					M				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : AC Machines (ACM) **COURSE CODE** : 6427

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	01	02	07	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

This course describes facts, concepts, principles & procedure for operations & performance characteristics of electrical machines such as induction motor, synchronous motor & alternator. These AC machines are widely used in industries for different applications & for generation of electricity. Hence knowledge of this course will make the student to perform effectively & efficiently when they work in industry.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know the facts, constructional details and working principle of AC machines
2. Select the appropriate AC motor for particular application from its behavioural characteristics.
3. Follow check list of actions for operation and control of AC machines
4. Understand various starting and speed control methods of induction motor.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify parts of three phase AC machines and operate three phase AC machines.
2. Analyse behaviour of three phases AC machines from its characteristics.
3. Measure and calculate various electrical performance parameters of three phases AC machines.
4. Select various electrical parameter controlling aids to three phase AC motor.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Alternator**	1a. Identify parts of alternator and Describe function of each part 1b. Differentiate between types of alternator 1c. State the use damper winding 1d. Explain the advantages of rotating field and stationary armature. 1e. Relate alternator Speed and Frequency. 1f. State the need of	1.1 Construction of three phase Alternator: a. Armature b. Rotor-Smooth cylindrical & salient types 1.2 Advantages of stationary armature and rotating field over rotating armature and stationary field & use of damper winding 1.3 Speed & frequency a. Armature windings: Concept of Single layer b. Two layer winding 1.4 Derivation of EMF equation of alternator which includes: a. Pitch factor/Chording factor	18

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	Pitch factor and Distribution factor. 1g. Derive the Equation and calculate Pitch factor and distribution factor. 1h. Derive EMF equation and calculate emf of alternator. 1i. State the cooling methods 1j. Explain various excitation systems 1k. Explain factors affecting terminal voltage of alternator 1l. Calculate regulation of an alternator	b. Distribution or Breadth factor (Numerical on above) 1.5 Cooling & ventilation 1.6 Different excitation systems: a. Using Pilot and Main exciter b. Using an AC exciter c. Brush less excitation System d. Static excitation system 1.7 Factors affecting the terminal voltage of alternator: a. Armature resistance drop b. Leakage reactance drop c. Armature reaction at various power factors 1.8 Concept of synchronous impendence 1.9 Tests on alternator to determine efficiency & Regulation: a. Direct loading method b. Synchronous impedance or EMF method c. The Ampere turn Or MMF method (Numerical on Regulation)	
Unit-II **Synchronous Motor**	2a. Explain working principle of synchronous motor 2b. State the importance of load angle. 2c. Describe effect of changing excitation and load on the behaviour of synchronous motor 2d. Describe the concept of hunting 2e. Calculate losses and efficiency of synchronous motor.	2.1 Operating principle of synchronous motor 2.2 Methods of starting 2.3 Concept of load angle (Coupling angle) 2.4 Motor on load with constant Excitation 2.5 Effect of increased load with different Excitation: (a)Normal (b)Under (c)Over 2.6 Concept of different torque: starting torque, running torque, pull in torque, pull out torque 2.7 'V' curves & inverted 'V' curves 2.8 Hunting or phase swinging 2.9 Losses in synchronous machine & efficiency. 2.10 Applications of synchronous motor	16
Unit-III **Fundamentals of Three Phase Induction Motor**	3a. Explain construction and working of three phase induction motor. 3b. Compare the types of three phase induction motor. 3c. Define the concept of Slip. 3d. Derive the rotor induced emf and torque equation of three phase induction	3.1 Construction of three phase induction motors (Squirrel cage & Slip ring type) 3.2 Concept &production of rotating magnetic field 3.3 Principle of working/ operation 3.4 Concept of synchronous speed & slip of induction motor (Numerical) 3.5 Expression for rotor induced EMF, rotor frequency& rotor current, reactance under steady & running conditions 3.6 Relation between torque & rotor power factor	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	motor. 3e. Calculate emf induced and torque of three phase induction motor at standstill and running condition. 3f. Derive the condition and calculate maximum torque	3.7 Torque equation, Determination of starting torque, running torque, Max torque, Full load torque (For Squirrel cage & Slip ring type) (Numerical) 3.8 Condition for maximum starting torque 3.9 Condition for maximum torque under running conditions	
Unit-IV **Performance of Induction Motor**	4a. Draw and explain Torque speed characteristic of three phase induction motor. 4b. Apply methods of slip measurement 4c. Calculate losses and efficiency of induction motor. 4d. Predict Performance of induction motor from equivalent circuit and vector diagram 4e. Enlist and explain Speed control and starting methods as applicable to three phase induction motor. 4f. Know the applications of three phase induction motor. 4g. Know how to calculate performance of induction motor from circle diagram. 4h. Compare three phase induction motor with synchronous motor.	4.1 Torque –Slip characteristics of three phase induction motor 4.2 Effect of change in supply voltage on torque slip characteristics 4.3 Effect of change in rotor circuit resistance on torque slip characteristics 4.4 Measurement of slip by: a. Tachometer method b. Compare stator frequency and rotor frequency c. Stroboscopic Method 4.5 Losses, efficiency & power stages in three phase induction motor (Block diagram) (Numerical) 4.6 Induction motor as a generalized transformer Vector diagram of Induction motor 4.7 Equivalent circuit of 3-Φ induction motor (No Numerical), Approximate equivalent circuit 4.8 Speed control of 3-Φ induction motor: (No Numerical) a. Pole changing method b. Frequency control method c. By stator voltage control d. By rotor resistance control (for slip ring induction motor) e. VVVF method 4.9 Starting methods of 3Φ induction motor: (No Numerical) a. Stator resistance starter b. Star Delta starter c. Auto transformer starter 4.10 Comparison between Squirrel cage & Slip ring type induction motor. 4.11 Applications of 3-Φ induction motor 4.12 Introduction to Circle diagram. (No numerical) 4.13 Double cage induction motor: a. Construction & principle of operations	18

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		b. Characteristics of outer cage, inner cage & combined cage c. industrial applications 4.14 Comparison between Induction motor & synchronous motor	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Alternator	04	10	08	22
II	Synchronous Motor	02	12	04	18
III	Fundamentals of Three Phase Induction Motor	04	06	04	14
IV	Performance of Induction Motor	06	10	10	26
	TOTAL	**16**	**38**	**26**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	To observe constructional details of alternator.	02
2	I	Determination of regulation of alternator by direct loading. i) Resistive ii) Inductive iii) Capacitive.	04
3	I	Determination of regulation of alternator by synchronous impedance method.	02
4	II	Plotting of 'V' curve and inverted 'V' curves of Synchronous motor.	04
5	III	To observe constructional details of three-phase induction motor.	02
6	III	Demonstration of direction reversal of 3-Φ induction motor.	02
7	IV	To perform No load and blocked rotor test on 3-Φ induction motor and determination of parameters from above test.	04
8	IV	Demonstration of various types of starters for 3-Φ induction motor.	02
9	IV	Speed control of 3-Φ slip ring induction motor by rotor resistance method.	02
10	IV	Speed control of 3-Φ induction motor VVVF method	02
11	IV	To find Slip of an 3-Φ induction motor by tachometer method/stroboscopic Method	02

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
12	IV	To Plot circle diagram of 3-∅ induction motor & determine various parameters of 3-Φ induction motor.	04
		TOTAL	**32**

Tutorials:

Sr. No.	Unit No	Tutorial Exercises (Outcomes in cognitive and affective Domain)	Approximately Hours required
1	I	Solve numerical on induced E.M.F. in an alternator	01
2	I	Solve numerical on voltage regulation of an alternator ▪ Synchronous impedance method ▪ Rothert's MMF method	02
3	II	Solve numerical on induced emf of synchronous motor	02
4	II	Solve numerical on power stages of synchronous motor	02
5	II	Solve numerical on finding maximum power of synchronous motor	02
6	II	Solve numerical on power factor improvement using synchronous motor	02
7	III	Solve numerical on calculating slip, rotor emf and current in Three phase induction motor	01
8	III	Solve numerical on calculating various torques of three phase induction motor	02
9	IV	Solve numerical on power stages of three phase induction motor	02
		TOTAL	**16**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the information of type and rating of alternators used in generating station
2. Compare conventional alternators with diesel generators
3. Collect specifications of induction motors used for various applications in an industry, Prepare a report on its speed control and starting method.
4. Prepare list of Motor and Generator/ Alternator manufacturing industries

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Use demo models for explaining construction of machines.
2. Arrange a visit motor manufacturing industries.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A text book of Electrical technology Vol II	B. L. Theraja, A. K. Theraja	S. Chand & Co.
2	Electrical Machines	S. K. Bhattacharya	Tata McGraw Hill
3	Electrical Technology	E. Hughes	E. L. B. S.
4	Electrical Technology	H. Cotton	E. L. B. S.
5	Electrical Machines	D. P. Kothari & I.J. Nagrath	Tata McGraw Hill

B) Software/Learning Websites

1. http://www.howstuffworks.com
2. www.engineersedge.com/motors.alternators_types.htm
3. www.allaboutcircuits.com/vol_2/chpt_13/8.html
4. www.allaboutcircuits.com/vol_2/chpt_13/9.html
5. www.allaboutcircuits.com/vol_2/chpt_13/10.html

6. http://en.wikipedia.org/wiki/Electric_motor
7. http://en.wikipedia.org/wiki/Synchronous motor

C) Major Equipments/ Instruments with Broad Specifications

1. Demo model of Synchronous machine
2. **Alternator- DC motor Set-**
   Alternator:-
   KW:- 3.5, RPM :-1500 rpm,
   Armature Ampere :- 4 amp, Armature output Volt :- 400,
   Field Volt :- 110, Field ampere :- 0.9 ampere,
   DC Motor :-
   KW:- 3 kVA, RPM :-1500 rpm,
   Armature Ampere :- 20 amp, Armature Volt :- 220,
   Field Volt :- 220, Field ampere :- 1 ampere, Winding :- Comp/ Shunt
3. **DC Shunt Generator- Synchronous motor set**
   Synchronous Motor:-
   KW:- 3.7, RPM :-1500 rpm, Amp:-7 Amp,
   Armature output Volt :- 400,
   DC Shunt generator:-
   KW:- 3, RPM :-1500 rpm,
   Armature output Volt :- 230,
   Field Volt :- 230
4. Demo model of Induction motor
5. Three Phase Squirrel cage induction motor.
   kW/HP: 3kW, R.P.M.- 1440, Volt:- 400 V, Amp.:6 A.
6. Three Phase Slip ring induction motor with rotor resistance starter
   kW/HP: 3kW, R.P.M.- 1440, Volt:- 415 V, Amp.:6 Amp., Frequency:50 Hz
   Rotor resistance starter: 15 Amp.
7. Squirrel cage induction motor with stator winding terminal for pole changing purpose.
   kW/HP: 3/2/1.5 kW, R.P.M.- 1400, Volt:- 415 V, Amp.:4.5/3.2/3 A., Frequency:50 Hz
8. Star Delta Starter, Auto Transformer Starter, DOL Starter
9. Digital Stroboscope

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H	M	H							
CO2		H	L								
CO3		M	H		L						
CO4		M	H							L	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Generation and Transmission of Electrical Power(GTP) **COURSE CODE :**6428

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	--	04	03	Max.	80	20	100	--	--	--	100
					Min.	32	--	40	--	--	--	--

1.0 RATIONALE:

Electrical Engineering Diploma holders employed in the field of power generation and transmission, mostly works in large thermal, hydro power stations, substations and switchyards. Some may hold independent charge of small generating station and substation. All of them need to know the various primary sources of energy available, the process of energy conversion, equipments necessary for these processes and their function. They get acquainted with transmission systems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. State the function of different auxiliaries / equipments used in power plants.
2. Describe the process involved in the conversion from other forms of energy to electrical engineering.
3. Select suitable site for different power stations.
4. Explain the factors considered while deciding load distribution.
5. Draw and Interpret Load curve and Load duration curve.
6. Solve problems on economical load distribution.
7. Understand factors affecting the efficiency of transmission
8. Differentiate various types of transmission systems.
9. Understand methods for minimizing effect of corona

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Classify conventional and non conventional energy sources.
2. Read and Interpret the layout of conventional power plant.
3. Identify the appropriate site for conventional power plant.
4. Select type of power plant according to load curve.
5. Classify various types of transmission systems.
6. Interpret the various transmission concepts.
7. Identify the factors affecting on efficiency of transmission system.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I Sources of Energy	1a. Define conventional and non conventional sources. 1b. Describe various non conventional sources. 1c. List types of Generating stations in Maharashtra with their Installed capacity	1.1 Conventional Sources**:** Fossil fuel, Nuclear and Hydraulic sources, Availability, Classification, cost, transportation and future scope. 1.2 Non- conventional Sources**:** Solar, tidal, geothermal, wind, biogas. 1.3 Relative merits and demerits of above sources. 1.4 Different types of generating	04

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		stations in Maharashtra with their Installed capacity.	
Unit-II **Thermal Power Station**	2a. Explain thermal energy conversion process with block diagrams 2b. Identify the appropriate site of a Thermal Power station 2c. Describe the working of thermal power station using single line diagram and Block diagram. 2d. State the functions of the major equipment and auxiliaries of a thermal power station	2.1 Introduction, 2.2 Selection of site, 2.3 Explanation through Line and block diagram of the system (No Constructional details) process taking at each stage. 2.4 Schematic (Power flow) diagram. 2.5 Steps which helps in increasing overall efficiency. 2.6 Functions of equipments used in each system such as: a. Coal and ash handling plant b. Boiler c. Economizer d. Air Preheater e. Super heater f. I. D. and F. D. fan g. Condenser h. Cooling towers. i. Steam turbines j. Ash precipitation. 2.7 Advantages & disadvantages.	08
Unit-III **Hydro Power Stations**	3a. Explain hydro energy conversion process with block diagrams 3b. Identify the appropriate site for a hydro-power station. 3c. Classify the different types of hydro-power station. 3d. State the functions of the major equipment and auxiliaries of a hydro-power station 3e. Solve the numerical to calculate the available Power in Hydro plant.	3.1 Introduction, 3.2 Selection of site, 3.3 Explanation through line and block diagram of the system. Schematic (Power flow) Diagram. 3.4 Classification of hydro-power station according to a. Head of water. b. Quantity of water. c. Load supplied. 3.5 Functions of following a. Catchment area b. Dam c. Spillways d. Surge tank e. Reservoir f. Pen stocks. g. Tail race etc. 3.6 Calculation of available power (Numerical also) 3.7 Advantages & disadvantages.	08
Unit-IV **Nuclear Power Stations**	4a. Explain energy conversion process with block diagrams 4b. Identify the appropriate site for a Nuclear Power station. 4c. Explain the working of nuclear power station	4.1 Introduction, 4.2 Fission and chain reaction. 4.3 Site selection 4.4 Explanation through line and block diagram of the system. Schematic (Power flow diagram) 4.5 Concept of nuclear Reactor, Types of nuclear reactor.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	4d. Describe various types of reactors 4e. State special precautions required for Nuclear power station.	4.6 Moderation and control 4.7 Heat exchanger and disposal of nuclear waste 4.8 Special precautions for nuclear power plant 4.9 Advantages & disadvantages.	
Unit-V **Diesel and Gas Power Plant**	5a. With single line diagram describe the electrical energy conversion process of Diesel power plant 5b. Explain working Principle of gas turbine power plant. 5c. Classify Gas turbine power plant. 5d. Compare different power plants.	5.1 Introduction 5.2 Selection of Site 5.3 Explanation through line and block diagram of the system 5.4 Diesel Engine: Working Principle, Components of diesel engine. Line diagram of fuel system and water cooling system, Lubricating system and methods of engine starting. 5.5 Advantages and disadvantages and applications of diesel power station 5.6 Gas Turbine power Plant ▪ Working principle with schematic arrangement ▪ Classification: Open cycle & close cycle ▪ Advantages & Disadvantages 5.7 Comparison between different power stations: With respect to site, initial and running cost, sources of energy, simplicity and cleanliness, stand by losses, maintenance, Pollution and environmental conditions	06
Unit-VI **Deregulated Power System**	6a. State Concept of Co-generation and Captive power plant. 6b. State concept of Distributed Generation.	6.1 Introduction to concept of Co-generation and Captive power plant 6.2 Introduction to concept Distributed generation	02
Unit-VII **Performance of Power Station**	7a. Draw Load curve and Load duration curve. 7b. Define different related terms for Load curve. 7c. State the significance of Load Factor and Diversity factor. 7d. Calculate the number of units and their rating for a given load curve. 7e. Explain the concept of economical load division between power stations. 7f. State the advantages and disadvantages of state, regional and national grid system.	7.1 Load Curve and Load duration Curve. 7.2 Definitions of the following: 7.3 Connected Load. 7.4 Maximum Demand. 7.5 Average Demand. 7.6 Installed capacity and rated capacity. 7.7 Load Factor, diversity factor and demand factor, plant use factor. 7.8 Choice of number and rating of units for a given load curve and operational schedule (Numerical also) 7.9 Concept of economical load division between power station for a given load duration curve, Base load and peak load station.	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		7.10 Interconnection of power station, Advantages and disadvantages, state, regional and national grid system in India.	
Unit-VIII **Transmission System:**	8a. State and Compare different Transmission systems. 8b. State various Types of supporting structure, insulator and conductor. 8c. Define string efficiency. 8d. Explain methods of improving string efficiency. 8e. Explain the concept of sag 8f. Calculate transmission line parameters. 8g. Explain the concept of short, medium and long transmission lines. 8h. State effects of voltage and power factor on Efficiency of transmission line. 8i. Explain Skin and proximity effect 8j. Explain Nominal T and πmethods for medium and long transmission lines	8.1 Various Electrical transmission systems and their comparison 8.2 Requirement, types & field applications of poles & supporting structure and clearance from ground. 8.3 Requirement, types and field applications of insulator and their merits and demerits. Causes of failure of insulator. 8.4 Conductors: CU, Al, ACSR Bundle conductor, purpose of stranding and their trade names. 8.5 String efficiency: Definition, voltage distribution along string, methods of improving string efficiency. (Numerical based on string efficiency.) 8.6 Concept of sag, spacing between conductors & span length. 8.7 Performance of Transmission line**:** ▪ Transmission line parameters like R, L, C value of these parameters for common types of conductors and their arrangements ▪ Effects of voltage and power factor on efficiency of transmission lines ▪ Concept of short, Medium and long transmission lines. Numerical on short transmission line. 8.8 Skin and Proximity effect, Ferranti effect 8.9 Nominal T and Л methods for medium and long transmission line 8.10 Classification and configuration of HVDC transmission system 8.11 Merit, Demerit and application of HVDC transmission system	19
Unit-IX **Corona**	9a. Define Corona. 9b. State Methods of minimizing the effect of corona. 9c. State advantages and disadvantages of Corona.	9.1 Definition, Formation 9.2 Advantages and disadvantages 9.3 Methods of minimizing effect of corona.	03
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Sources of Energy	02	04	---	06
II	Thermal Power Station	02	02	04	08
III	Hydro Power Stations	02	--	06	08
IV	Nuclear Power Stations	02	02	04	08
V	Diesel and Gas Power Plant	02	04	04	10
VI	Deregulated Power System	02	02	--	04
VII	Performance of Power Station	02	04	04	10
VIII	Transmission system	04	08	10	22
IX	Corona	02	02	--	04
	TOTAL	**20**	**28**	**32**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

Not Applicable

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Assignment on solving tutorial
2. Visit to nearby Thermal power station
3. Visit to nearby Hydro power station
4. Visit to nearby Solar PV station
5. Visit to nearby Wind farm
6. Visit to nearby diesel power plant
7. Collect data of conventional and nonconventional generation for Maharashtra.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video films or animation films on working of different type of power stations
2. From YouTube and other resources.
3. Visit to nearby power station
4. Visit to wind power plants
5. Visit to solar power plant
6. Visit to electrical substation

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electrical Power	Dr. S. L. Uppal	Khanna Publisher
2	A course in Electrical Power	Soni, Gupta, Bhatnagar	Dhanpat Rai & Sons
3	A course in Power plant Engineering	Dr. V. M. Domkundwar	Dhanpat Rai & Sons
4	Principles of power system	V. K. Mehta	S. Chand & Company
5	Transmission & Distribution	J. B. Gupta	S. K. Khanna
6	Generation of Electrical Energy	B. R. Gupta	S. Chand & Company

B) Software/Learning Websites

1. www.mahagenco.com
2. www.mahatransco.com
3. www.mahadiscom.co.in
4. www.alstomindia.com
5. www.udheindia.com

C) Major Equipments/ Instruments with Broad Specifications

Not Applicable

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		H	M								
CO3		H			M	L					
CO4		H									
CO5		H									
CO6		H	M								
CO7		H			M						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Switchgear and Protection (SGP) **COURSE CODE** : 6429

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	04	08	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

In Today's world electrical power is a prime requirement of society and industry. Switchgear and protection ensures a lot about stability of the power system. In order to ensure continuous power supply and maintain the power system, a student of Electrical Engineering should know the facts, concepts, principles & procedural aspects of switchgear and protection system. This will be helpful for them in discharging their duties as a supervisor or a technician in substations, manufacturing industries & public service utilities.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Learn the principles, concepts and procedural aspects of switchgear and protection.
2. Identify the various components of switchgear and protection systems.
3. Know the specifications and select switchgear and protection system
4. Identify the faults and carried out remedial measures
5. Know the need of insulation co-ordination.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Able to classify and identify various types of faults in Power system.
2. Explain working of different types of circuit breakers in power system.
3. Explain working of different types of relays in power system.
4. Maintain the protection of transmission line and feeder from various faults.
5. Demonstrate protection of transformer, alternator, motor and bus-bar.
6. Protect power system against over voltages.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of Protection**	1a. Describe the functions of basic elements of a protective system 1b. Describe the various types of faults and abnormalities occurring in a power system. 1c. Explain the concept of the Backup protection 1d. Describe the working of current limiting reactors and their arrangements	1.1 Necessity, functions and components of protective system with symbols. 1.2 Normal and abnormal conditions. 1.3 Types of faults and their causes. 1.4 Protection zones and backup protection 1.5 Short circuit calculations (Symmetrical faults only) 1.6 Need of current limiting reactors and their arrangements.	04
Unit-II	2a. Describe protective	2.1 HRC fuses – construction, types,	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Circuit Interrupting Devices	system showing different circuit interrupting devices using a line diagram 2b. Explain the operation of isolator circuit breaker and HRC fuse and also LT circuit breakers. 2c. Explain the terms associated with fuse and circuit breaker. 2d. Explain characteristics of fuse and circuit breakers. 2e. Explain arc formation and high resistance and zero current interruption. 2f. Describe selection of the proper rating of circuit breaker	working, characteristics, selection and applications 2.2 Isolators- vertical break, horizontal break and pantograph type 2.3 Arc formation process, methods of arc extinction, related terms. 2.4 Circuit breakers- Concept, Classification, Working principle, Construction, Specification and Applications of Sulphur Hexa Fluoride (SF6) Circuit breaker. Vacuum circuit breaker. 2.5 L.T.- Air circuit breakers (ACB), miniature circuit breakers (MCB), Moulded case circuit breakers (MCCB), Earth leakage circuit breaker (ELCB), Residual Current Circuit Breaker(RCCB), Comparison of fuse and MCCB, Selection and rating of LT and HT circuit breakers for various electrical installations. 2.6 Introduction to gas insulated switchgear (GIS).	
Unit-III **Protective Relays**	3a. Describe need for different types of relays. 3b. State the terms related to relays. 3c. Explain concept of over current and directional relays. 3d. Explain construction and working principle of various relays 3e. Explain setting of relays. 3f. Solve simple numerical on the PSM and TSM of relays.	3.1 Relay Fundamental Requirements (Qualities) - Selectivity, Speed, Sensitivity, Reliability, Simplicity, Economy. 3.2 Basic relay terminology- Protective relay, relay time, Pick up current, Reset current, current setting, Plug setting multiplier, Time setting multiplier. 3.3 Protective relay, classification, Principle of working, construction and operation of electromagnetic induction (shaded pole, watt-hour meter and induction cup), Thermal relay, static relays. 3.4 Over current relay-Time current characteristics. 3.5 Microprocessor based over current relays. 3.6 Distance relaying- Principle, operation of definite distance relays 3.7 Directional relay (watt-hour meter). 3.8 Differential Relay. (Simple numerical on relay setting, PSM, TSM)	12
Unit-IV	4a. Explain the faults and abnormalities in	**Alternator Protection** 4.1 Alternator Abnormalities and	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Protection of Alternator, Transformer, Motor and Busbar	alternator. 4b. Explain various protection schemes of alternator. 4c. Explain abnormalities and various protection schemes for transformer. 4d. Describe the inrush current phenomenon in transformer. 4e. Explain the protection offered by Buchholz Relay. 4f. Explain various faults occurring in motor and their protection schemes. 4g. Explain Differential protection of Bus bars. 4h. Compare various protection scheme of transmission line. 4i. Describe the criteria to selection the protection scheme 4j. Explain distance protection. 4k. Explain need of carrier aided protection. 4l. Explain protection of feeders and ring mains and Bus bar.	Faults 4.2 Differential protection (basic and modified) 4.3 Over current, earth fault, inter turn fault, negative phase sequence, over heating protection, field failure protection 4.4 Reverse power protections. (Simple numerical on differential protection) **Transformer Protection** 4.5 Transformer Abnormalities and faults. 4.6 Differential, over current, earth fault, inter turn, restricted earth fault, over heating protection. 4.7 Buchholz relay (Simple numerical on differential protection) **Protection of Motor** 4.8 Abnormalities and faults. 4.9 Short circuit protection, Overload protection, Single phase preventer Protection of Bus bar and transmission line 4.10 Abnormalities and faults. 4.11 Bus bar protection. 4.12 Transmission line, over current, distance protection. Pilot wire protection.	08 04 06
Unit-V **Over Voltage Protection**	5a. State the causes of over voltage. 5b. Explain the operation and characteristics of Lightning Arrestor. 5c. Describe the Insulation co-ordination and basic impulse insulation Level	5.1 Causes of over voltages. 5.2 Lighting phenomena and over voltage due to lightning. 5.3 Protection of transmission line and substation from direct stroke. 5.4 Types of lightning arresters and surge absorbers and their construction and principle of operation. 5.5 Protection against travelling waves. 5.6 Need of Insulation co-ordination, volt- time characteristic and basic impulse insulation level	06
Unit-VI **Neutral Earthing**	6a. State the importance of neutral earthing. 6b. Explain the types of neutral earthing. 6c. Distinguish between the equipment and neutral earthing.	6.1 Introduction and importance. 6.2 Types of neutral earthing 6.3 Substation earthing 6.4 Difference between Equipment earthing and Neutral earthing	04
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamentals of Protection	04	02	--	06
II	Circuit Interrupting Devices	06	04	04	14
III	Protective Relays	06	04	04	14
IV	Protection of Alternator	02	04	04	10
	Protection of Transformer	02	04	04	10
	Protection of Motor	02	02	02	06
	Protection of Busbar	02	02	02	06
V	Over voltage Protection	02	04	02	08
VI	Neutral Earthing	02	02	02	06
	TOTAL	**28**	**28**	**24**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	II & III	Collect specification of various switchgear equipments different switchgear equipments used in Electrical power system through market survey/visit and write a technical report.	08
2	II	To demonstrate the operation of MCB/MCCB under the normal and abnormal condition.	04
3	II	To plot Current (I) Vs Time (T) characteristics of fuse (Kit kat / HRC) by performing the load test.	06
4	II	To identify the components of different types of circuit breakers with their specifications (through visits / video / model).	06
5	III	To Demonstrate plug and time setting (PSM, TSM) To of induction disc electromagnetic relay.	06
6	IV	To perform the differential protection of transformer on the power system simulation model.	06
7	IV	To perform transmission line protection by using the impedance relay/over current relay for various fault. (On transmission line protection simulation model).	06
8	IV	To demonstrate the operation of single phasing preventer for protection of 3 phase induction motor	06
9	V	To understand various types of lightning arrestor and specifications visit the substation/manufacturing industry and write a report.	08
10	VI	To understand various types of neutral earthing and specifications of earthing at different substations / different locations and new trends in earthing schemes (Information Search).	08
		TOTAL	**64**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect from market the catalogues of MCB, MCCB ELCB.
2. Collect the information on switch gear components from nearby place
3. Trace the connection diagram of control circuit of CB.
4. Download the video of functioning of circuit breaker, Lightning arrester.
5. List different Manufactures of Switchgear equipment and list out the technical specifications of their equipment from their websites.
6. List out the earthing materials with specifications.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration on working of circuit interrupting devices.
2. Arrange a visit to switchgear manufacturing industry/substation to understand the working of switchgear components.
3. Arrange expert seminar of industry person in the area of modern switchgear technology.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Switch Gear and Protection	Sunil Rao.	Khanna Publications, New Delhi.
2	A Text Book on Electrical Power System	Soni, Gupta & Bhatnagar.	Dhanpatrai & Sons, New
3	A Text Book of Electrical Power	Uppal, S.L	Khanna Publication, New Delhi
4	Power System Protection and Switchgear	Badriram & Vishwakarma P.N.	TMH, New Delhi
5	Principles of Power System	V. K. Mehta	S. Chand & Co.
6	Switchgear and Power System Protection	R. P. Singh	PHI Publishers
7	Switchgear and Protection	Gupta J. B.	Katariya Publication, New Delhi

B) Learning Websites

1. www.nptel.iitm.ac.in
2. http://electrical-engineering-portal.com/download-center/electrical- software
3. www.cselectric.co.in
4. www.abb.co.in/ProductGuide/
5. www.schneider-electric.co.in

C) Major Equipments/ Instruments with Broad Specifications

1. Power System Simulator (with Induction disc type over current, earth fault Relay.)
2. Different types of MCB MCCB and ELCB.
3. Feeder Protection Simulation experimental unit (Including Transmission line model, protective relay, CT PT Indicators with control switches)
4. Three phase 440V, 50 Hz, 1460 rpm Squirrel cage induction motors with single phasing preventer unit.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H									
CO2		H									
CO3			M								
CO4				H		L					
CO5								M			
CO6				H							

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Testing and Maintenance of Electrical Machines (TME) **COURSE CODE :** 6430

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

The majority of the diploma holders in Electrical Engineering are absorbed by the industry & state electricity boards where they are expected to do routine, preventive & breakdown maintenance of electrical equipments, to inspect & assist in testing the manufacturer & commissioned equipments as per ISS & to install machine as per manufactured instructions. As an engineer in charge of a substation, sub-division or any electrical installation he has to know IE act & statutory under him. Accordingly all essential topics have been covered in this course.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the various causes of failure of electrical machines.
2. Understand the various types of maintenance & prepare the schedule of maintenance.
3. Understand the conditions & procedure for parallel operation of transformers, alternators.
4. Implement the various methods/procedures prescribed as per IS code of Practice in testing of electrical machines.
5. Apply techniques/steps to rectify and repair the faults in electrical machines.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Prepare schedule of maintenance for electrical machines in an industry.
2. Carryout periodic maintenance (Routine/preventive/breakdown) of electrical machines.
3. Maintain history sheet/ log book for prediction of repeated faults.
4. Identify, locate and define the fault in an electrical machine.
5. Use proper tools and equipments for testing and maintenance of electrical machines.
6. Measure the parameters of machine after maintenance to ensure its performance
7. Report the fault.
8. Synchronising the transformer and alternator with bus bar or other machine.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of Testing**	1a. State the causes of failure, importance, types and procedure of maintenance. 1b. State and classify Objectives of testing 1c. Describe significance of TPM, tolerance, IP code	1.1 Causes of failure of electrical equipments. 1.2 Role of Bureau of Indian Standards (BIS) in testing 1.3 Significance of Maintenance of Electrical Equipment. 1.4 Types of Maintenance-Routine, Preventive and breakdown Maintenance 1.5 concept of TPM, pillars of TPM 1.6 Factors affecting the preventive	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		maintenance schedule, Procedure for developing Preventive maintenance schedule 1.7 Objectives of Testing 1.8 Categories of tests 1.9 Tolerance 1.10 Ingress protection for solids & Liquids, IP marking	
Unit-II **Testing and Reconditioning of Insulation**	2a. list the factors affecting life of insulation 2b. Describe the condition of insulation through various tests. 2c. Confirm the quality of insulation oil and reconditioning it.	2.1 Factors affecting life of insulation. 2.2 Measurement of insulation resistance by megger, voltmeter, Dielectric absorption, Polarisation 2.3 Reconditioning of insulation • Cleaning and drying • Re-varnishing • Construction and working of vacuum Impregnation plant 2.4 Properties of good insulating oil 2.5 Testing of Transformer oil as per IS 1866 • Dielectric strength test • Acidity test • Sludge test • Crackle test • Flashpoint and fire point test 2.6 Methods of purification and filtering of insulating oil • Centrifugal purifiers • Streamline Filter (Vacuum type)	10
Unit-III **Testing of DC Machines**	3a. Measure winding resistance by different methods. 3b. Explain the proper tools for maintenance 3c. Describe the factors affecting life of insulation 3d. Describe the testing of DC machines and reconditioning the machine.	3.1 Electrical Tests before commissioning of rotary electric machines. 3.2 Measurement of winding resistance of transformer & stator, armature, field resistance of rotary electric machines. 3.3 Use of Bearing Puller, Filler Gauge, Growler, Dial Indicator, Spirit Level in maintenance of electrical Equipment 3.4 List of routine, type, supplementary, special tests on DC Machine as per IS 9320. 3.5 Swinburne's test, Brake test, Hopkinson's test 3.6 Numericals on above (3.4) tests.	10
Unit-IV **Testing of Transformer**	4a. Describe the tests to find voltage ratio 4b. Describe the tests to Locate corresponding phase windings. 4c. Describe testing the	4.1 List of routine, type, supplementary, special tests on transformers as per IS 2026. 4.2 Measurement of voltage ratio by Ratio meter, Standard transformer, Turn testing method. 4.3 Nomenclature of transformer	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	transformer and recondition it.	terminals As per IS-2026 4.4 Polarity test 4.5 Phasing out test 4.6 Back to Back test 4.7 Numericals on Back to Back test 4.8 Insulation resistance & dielectric test of transformer 4.9 Separate source voltage withstand test, 4.10 Induced over voltage withstand test, 4.11 Lightening impulse test	
Unit-V **Testing of induction motor**	5a. Describe the testing of induction motor by various methods. 5b. Analyse /interpret the data to recondition the machine.	5.1 List of routine, type, supplementary, special tests on induction motors as per IS 4029. 5.2 Reduced voltage running up test 5.3 Open circuit voltage ratio test for slip ring induction motor 5.4 High voltage test 5.5 Temperature rise test 5.6 Momentary overload test	08
Unit-VI **Maintenance Schedule And Troubleshooting Charts.**	6a. List the probable faults. 6b. Describe the faults and provide solution for the fault.	6.1 Need for Trouble shooting Charts 6.2 Trouble shooting Charts for: • DC Machines • Alternator • Three Phase induction motors • Transformer 6.3 Preventive Maintenance schedule for: • DC Machines • Alternator • Three Phase Induction Motor • Transformer 6.4 Condition Monitoring	08
Unit-VII **Parallel Operation of Transformers and Alternators**	7a. State the necessity and methods of parallel operation. 7b. Perform and Monitor the parallel operation 7c. Predict the load shared by machines operating in parallel.	7.1 Necessity and conditions for Parallel operation of transformers 7.2 Load sharing, Factors affecting parallel operation of transformers 7.3 Necessity and conditions for synchronization of alternators 7.4 Synchronizing alternators by • Lamp bright (one lamp dark & two lamp bright) method. • By using synchroscope 7.5 Factors affecting the parallel operation and load sharing of alternators 7.6 Numerical on parallel operation of transformers & alternators	10
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basics of Testing	02	04	04	10
II	Testing and Reconditioning of Insulation	02	04	04	10
III	Testing of DC Machines	04	04	08	16
IV	Testing of Transformer	04	04	08	16
V	Testing of induction motor	02	02	02	06
VI	Maintenance Schedule And Troubleshooting Charts.	02	02	02	06
VII	Parallel Operation of Transformers and Alternators	04	04	08	16
	TOTAL	**20**	**24**	**36**	**80**

Legends: R = Remembrance (Knowledge); U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	IV	Perform impedance voltage test on transformer.	02
2	IV	Perform Back to Back test on two single phase transformers.	04
3	III	Perform a running light test (Swinburne's test) on DC shunt motor & find out its efficiency at different load conditions	04
4	III	Perform a brake test on DC Shunt motor & determine its characteristics such as output Vs torque, output Vs speed, Output Vs efficiency and Output Vs line current	04
5	V	Demonstration of parallel operation of Alternator	04
6	IV	Perform a no load test on single phase induction motor	02
7	IV	Perform Reduced voltage running up test on 3 phase induction Motor	02
8	VI	Perform a brake test on three phase induction motor & find out performance Characteristics such as output vs torque, output Vs efficiency and output vs speed.	04
9	VII	Fault finding, trouble shooting of Transformer, DC Machine, Induction Motor Prepare preventive maintenance schedule for Distribution transformer, Three Phase Induction Motor	04
10	IV	Determination of dielectric strength of transformer oil	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collecting related IS codes of practice required for testing of particular machine and understand the procedures for testing.
2. Study of IP codes used for LED fittings used for street lighting.
3. Visit an electrical motor rewinding shop and write maintenance problem, methods of fault finding, tools/equipment used for fault rectification, provide solution to the fault.
4. Visit nearby electrical motor manufacturing unit and write materials, methods/ techniques used in construction of machines.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A text book of Electrical technology Vol II	B. L. Theraja, A. K. Theraja	S. Chand & Co.
2	Electrical Machines	S. K. Bhattacharya	Tata McGraw Hill
3	Preventive Maintenance of electrical machines &equipments Vol-I	S. Rao	M. P. Publication
4	Preventive Maintenance of electrical machines &equipments Vol-II	S. Rao	M. P. Publication

B) Software/Learning Websites

1. http://law.resource.org/pub/in/bis/ (For various IS code of practice)

C) Major Equipments/ Instruments with Broad Specifications

1. Set of two identical Transformers single 2.5kVA, 50 Hz, 220 V/110 V
2. Three phase 3 or 5 HP, 50 Hz, 440 V induction motor
3. 3HP 220 V DC shunt Motor
4. Ammeters AC/DC (0-1)A, (0-3A), (0-5)A, (0-10) A
5. Voltmeters (0-150/250/500) V
6. Wattmeters L.P.F. (0-1000) W, 5/10A
7. Multimeter
8. Megger
9. Rheostats (110Ω 2.8A), (140 Ω, 2.8A), (360 Ω, 1.2A)
10. DC Shunt and Induction motor with loading arrangements.
11. Oil testing kit: capable of applying 60 kV

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1			H							L	
CO2			L	H							
CO3		H									
CO4				H							
CO5				H							
CO6		H					M				
CO7								L	H		
CO8			H								

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Special Purpose Electrical Machines(SPM) **COURSE CODE** : 6431

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	25	--	25	150
					Min.	32	--	40	10	--	10	--

1.0 RATIONALE:

Day by day the interest on special machines increases due to expanding industrial activities, because these machines serves for several applications. Diploma students will be introduced with special machines which have wide applications in industry, robotic and automatic. It is expected that the knowledge of construction, working principles, basic characteristics of these motor must be known by students which ultimately help the students in discharging their duties in industries as a technician.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the construction and working principles of different single phase motors.
2. Calculate parameters of equivalent circuit of different single phase motors.
3. Apply the knowledge of equivalent circuit and predict the performance of the motor.
4. Select single phase motor for a given application.
5. Understand the process of commutation and EMFs induced during commutation

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Classify the single phase motors.
2. Explain the concept of production of rotating magnetic field in single phase motors.
3. Compare different techniques of starting the single phase motors.
4. Express various electrical parameters and their interrelationships in the form of Phasor diagrams.
5. Describe the performance of the single phase motors by mathematical manipulation of data available.
6. Classify advance electrical single phase machines such as BLDC, Stepper, Linear induction motors.
7. Select the proper advance electric machine for a given application.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Single Phase Induction Motors**	1a. Explain the construction and working of Single Phase Induction Motors 1b. Describe concept of revolving field 1c. Explain starting methods 1d. Describe equivalent	1.1 Constructional details 1.2 Revolving field theory 1.3 Classification 1.4 Starting methods ▪ Split phase ▪ Shaded pole ▪ Repulsion ▪ Reluctance 1.5 Equivalent circuit ▪ At standstill	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	circuit parameters. 1e. state advantages/ disadvantages over three phase induction motor 1f. State applications of single phase induction motor	▪ At no load ▪ Under blocked rotor 1.6 Numericals on calculating equivalent circuit parameters 1.7 Comparison with three phase induction motor 1.8 Characteristics of split phase, shaded pole, repulsion, reluctance type single phase induction motor and their applications.	
Unit-II **Single Phase Synchronous Motors**	2a. Describe the construction and working of Single Phase synchronous motors 2b. State the applications of single phase synchronous motors	Working principle, construction and applications of…. 2.1 Single Phase Reluctance Motor 2.2 Hysteresis motor 2.3 Two phase servo motor 2.4 AC tachometers	10
Unit-III **AC Commutator Machines**	3a. Describe various EMFs induced during commutation. 3b. Explain Phasor diagrams 3c. Describe working and phasor diagrams of compensated and repulsion motor.	3.1 Necessity/ advantages of AC commutator motors 3.2 EMFs induced in commutator windings (E_r and E_t) 3.3 Emfs produced by rotating magnetic field E_{RT} 3.4 Numericals based on EMFs induced 3.5 Torque Expression 3.6 Commutation in AC machines and EMF's under commutation 3.7 Single Phase Series Motors. 3.8 Phasor Diagram & Simplified Phasor Diagram (no derivation) 3.9 Compensated AC series motor 3.10 Phasor Diagram & Simplified Phasor Diagram (no derivation) 3.11 Repulsion motor, Phasor Diagram & Simplified Phasor Diagram (no derivation)	12
Unit-IV **Linear Induction and Stepper motors**	4a. Describe construction, working and classify LIM, stepping motor 4b. Describe Linear force and state the comparison of LIM with RIM 4c. List the applications	4.1 Construction and Working of linear induction motor. 4.2 Classification 4.3 Comparison between LIM and RIM (Advantages, disadvantages of LIM) 4.4 Derivation of linear force 4.5 Applications of linear Induction motor 4.6 Construction and Working of Stepper motor 4.7 Variable reluctance type, Permanent magnet type & Hybrid stepper motor. 4.8 Applications of Stepper motor	12
Unit-V **Advanced**	5a. Describe construction, working and classify	5.1 Synchronous Reluctance Motors, Constructional features – Types – Axial and radial air gap motors – Operating	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Electrical Machines	Synchronous Reluctance Motor, Switched Reluctance Motor, BLDC, Permanent Magnet Synchronous Motors and their application. 5b. State the properties/ advantages of Amorphous core 5c. Describe construction, working, advantages of Soft starters	principle, Applications 5.2 Switched Reluctance Motors, Constructional features – Principle of operation, Applications 5.3 Permanent Magnet Brushless DC Motors, Principle of operation Types and Applications 5.4 Permanent Magnet Synchronous Motors, Principle of operation – EMF and torque equations, Applications 5.5 Amorphous core transformer 5.6 Introductions of soft starters	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Single Phase Induction Motors	04	08	08	20
II	Single Phase synchronous Motors	06	03	03	12
III	AC Commutator Machines	04	04	07	15
IV	Linear Induction and stepper motors	04	04	07	15
V	Advanced Electrical Machines	05	05	08	18
	TOTAL	**23**	**24**	**33**	**80**

Legends: R = Remembrance (Knowledge); U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Plot torque speed characteristic of split phase I. M. by conducting brake test on the motor	04
2	I	Plot torque speed characteristics of single phase capacitor start induction run induction motor by conducting brake test on the motor	04
3	I	Plot torque speed characteristic of single phase capacitor start and run induction motor by conducting brake test on the motor.	02

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
4	I	Plot torque speed characteristics of shaded pole induction motor by conducting brake test on the motor	02
5	I	Plot torque speed characteristic of repulsion motor by conducting brake test on the motor	02
6	I	Plot torque and Speed characteristic of universal motor. (on AC & DC supply)	04
7	II	Plot torque speed characteristic of reluctance motor by conducting brake test on the motor	02
8	II	Plot torque speed characteristic of Hysteresis motor by conducting brake test on the motor	04
9	V	Demonstration of speed and reversal of direction of stepper motor	04
10	I	Dismantling and reassembling of single phase motors used for ceiling fans, universal motor for mixer	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Dismantle and reassemble other single phase motors.
2. Reversing direction of rotation of single phase induction motor
3. Visit small water pump, mixer, domestic appliances rewinding shop

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

Not Applicable

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Generalized theory of Electrical Machines	Dr. P. S. Bimbra	Khanna
2	Electrical Machines	S. K. Bhattacharya	Tata McGraw Hill
3	AC Commutator machines	Taylor	Wheeler
4	A Text book of Electrical Technology	B. L. Thareja & A. K. Thareja	S. Chand & Company

B) Software/Learning Websites

1. http://en.wikipedia.org/wiki/**Stepper_motor**
2. http://en.wikipedia.org/wiki/**Brushless_DC**_electric_**motor**
3. www.learnengineering.org/2014/10/**Brushless-DC**-**motor**.html
4. www.**softstarter**.org/how-does-**soft**-start-work-959233.html

C) Major Equipments/ Instruments with Broad Specifications

Following F.H.P. single phase motors with an arrangement to conduct brake test:

1. Split phase Induction motor
2. Capacitor start induction run induction motor
3. Capacitor start and run induction motor
4. Shaded pole induction motor
5. Repulsion motor
6. Universal motor
7. Reluctance motor
8. Hysteresis motor

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H									
CO2		H									
CO3			H	L							
CO4		M	H								
CO5	H	M	L								
CO6				H							
CO7					H						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Distribution and Utilization of Electrical Energy (DUE) **COURSE CODE** : 6432

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	--	50	150
					Min.	32	--	40	--	--	20	--

1.0 RATIONALE:

Electrical Energy is the most widely used form of energy by human being. The generated power before being utilized by the consumer has to pass through various stages. The electric power system has three stages generation, transmission and utilization.

The Diploma electrical engineer has to work on various electrical aspects of transmission & distribution system at different stages like erection and maintenance. They should know performance characteristics of transmission line and distribution system.

Another aspect of electrical system is utilization of electrical energy. The Diploma electrical engineer is therefore required to posses knowledge of performance and applications of electrical drives, electrical furnaces, electrical welding equipments and traction systems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know the design aspect of a distribution network
2. Understand layout of a substation
3. Compare different methods of electric heating and welding
4. Understand various types of load and electric drive system
5. Know the various facts of electric traction

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Decide the type of distributor based on requirement and determine the electrical performance of distributer.
2. suggest the type of substation for installation and Draw layout of a substation
3. Select type of electric heating or electric welding according to job
4. Propose suitable electric drive for a particular application
5. Identify the type of electric supply system for electric traction and calculate the parameters of the electric traction.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I Distribution	1a. Define and Classify and Compare distribution system 1b. Explain distribution system according to scheme of connection 1c. Enlist advantages and disadvantages of various systems	1.1 Definition of Distribution system 1.2 Classification of Distribution system 1.3 AC Distribution system 1.4 Connection scheme of Distribution system 1.5 Requirement of Distribution system and design consideration 1.6 Methods of solving distribution system.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	1d. Solve distribution network	1.7 Numerical based on topic 1.6. 1.8 Concept of Express feeder.	
Unit-II **Substation**	2a. Classify Substation 2b. Know the Suitability of Substation According to Location 2c. Enlist equipment and its function in substation 2d. Draw layout of Substation 2e. State the need of batteries in substation	2.1 Introduction 2.2 Classification of substation according to service, requirement & constructional features. 2.3 Advantages & disadvantages 2.4 Equipments in Substation 2.5 Bus bar arrangements in Substation 2.6 Connection Diagram & Layout of Substation, Indoor, Outdoor substation & control equipments & their use in substation, 2.7 Use of batteries in substation. 2.8 Introduction to compact substation 2.9 Do's and don'ts for substation operator as per IS. 2.10 Procedure for obtaining permits or line clear system while working on electrical network	08
		Utilization	
Unit-III **Electric Heating and Welding**	3a. State the principle of electric heating and welding 3b. Explain construction and working of electric heating and welding 3c. Describe required Properties of heating element 3d. Calculate the dimensions of heating element 3e. Solve numerical on induction and dielectric heating 3f. Know the applications of electric heating and welding	3.1 Principle of electric heating, their types & Advantages. 3.2 Modes of transfer of heat (conduction, convection & radiation) 3.3 Classification of electric heating methods. 3.4 Resistance heating- Principle of resistance heating, Construction, operation & Advantages & disadvantages. 3.5 Direct resistance heating- Salt bath furnace 3.6 Indirect Resistance Heating- Resistance Ovens. 3.7 Required properties of heating element, causes of failure of heating elements & control of temperature by various methods. 3.8 Induction Heating- Principle, Construction, & applications of induction heating 3.9 Core type induction furnaces: Ajax Wyatt & Tama furnace 3.10 Coreless type Induction Furnace 3.11 Indirect core Induction Heating Furnace 3.12 Dielectric Heating: Principles of Dielectric Heating, Advantages, Applications & Limitations of Dielectric Heating. 3.13 Simple numerals on above heating	16

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		process. 3.14 Electric Welding: Principles of electric resistance welding. Methods of Electric Welding : Electric arc welding, resistance welding. 3.15 Resistance Welding : Principles, Advantages, types of resistance welding. 3.16 Electric Arc Welding : Formation & Characteristics of electric arc, effects of arc length 3.17 Principle of electric arc welding: Types, advantages, disadvantages & applications of all types. 3.18 Comparison with resistance welding & Electric Arc welding	
Unit-IV **Industrial Electric Drives**	4a. Define and Compare the types of electric drive 4b. State the performance requirement of an electric drive 4c. Know the Electrical and mechanical characteristics for selection of electric drive 4d. Select the electric motor as drive. 4e. Explain load Equalization and duty cycles 4f. Solve numerical to find rating of electric drive	4.1 Introduction, advantages & disadvantages of electric drive. 4.2 Types of electric drives. 4.3 Performance requirement of an electric drive. 4.4 Selection of motor: Electrical Characteristics 4.5 Starting characteristics: Starting torque only (No starters). 4.6 Speed control methods- Suitability of economic and efficient speed control methods 4.7 Electric Braking: Types applicable to DC & AC Motors. 4.8 Mechanical Characteristics 4.9 Types of Bearing. 4.10 Transmission drive. 4.11 Noise Level. 4.12 Size of motor. 4.13 Factors affecting size of motor. 4.14 Standard ratings (examples) 4.15 Load Equalization meanings and means of obtaining it. 4.16 Duty cycles & Estimation of ratings or size of motors. 4.17 Simple numerals on 4.13	16
Unit-V **Electric Traction**	5a. List requirement of an ideal traction system 5b. Classify and explain traction systems 5c. Appreciate the systems of track electrification 5d. Draw block diagram of AC locomotive and explain function of each block	5.1 Requirement of an Ideal Traction System 5.2 Systems of traction - Non electric traction, Electric traction 5.3 Track electrification systems 5.4 Block diagram of AC locomotive and function of each block 5.5 Simple Catenary construction. 5.6 Traction Mechanics: Units used in traction mechanics, Types of services,	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	5e. Explain simple catenary construction 5f. Explain the types of traction services and apply suitable speed time curve 5g. Derive equations of various terms of Traction mechanics and solve numerical	Speed time curve, Simplified speed time curve, Average speed and scheduled speed, Factors affecting schedule speed, Tractive effort, Specific energy consumption, Factors affecting specific energy consumption, coefficient of adhesion, simple numerical on simplified speed time curve.	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Distribution	02	04	04	10
II	Substation	04	04	04	12
III	Electric heating & Welding	04	10	06	20
IV	Industrial Electric Drive	04	04	10	18
V	Electric Traction	04	08	08	20
	TOTAL	**18**	**30**	**32**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Calculation of voltage drops in distributor. (By taking suitable Examples)	02
2	II	Draw layout of indoor & outdoor substations & Write function of each equipments.	04
3	III	Demonstration of Resistance oven & Design of heating element. Write report of the same	04
4	III	Demonstration of dielectric heating oven. Write report of the same.	04
5	III	Demonstration of induction heating oven. Write report of the same.	02
6	III	Demonstration of spot welding machine. Write report of the same.	02
7	III	Demonstration of welding generator. Write report of the same	02
8	IV	Selection of drives for different purposes from characteristics of different	04

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
		motors.	
9	V	Observe catenary construction by visit to electrified track system.	04
10	V	Write a report on various traction systems & function of equipments used in AC locomotive.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Enlist the examples of interconnected substation and compact substation.
2. Observe the pole mounted substation and relate the theory.
3. Collect the specifications of distribution transformer by visiting a substation
4. Enlist the type, name of industry, its product and type of furnace used.
5. Enlist various types of drives and its application in the specified industry.
6. Collect the information of high speed locomotives in the world.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Arrange a visit to Distribution substation
2. Arrange visit to Indian Railway Institute of Electrical Engineering/ electrified track roots.
3. Arrange expert seminar of industry person in the area of electric drives.
4. Show video on the industrial application of electric heating systems.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A Course in Electrical Power	Soni, Gupta, Bhatnagar	Dhanpat Rai & Sons
2	Principles of Power System	V. K. Mehta	S. Chand & Company
3	A Course in Electrical Power	S. L. Uppal	S. K. Khanna
4	Utilisation of electrical energy	Openshaw Taylor	Orient Longman Ltd.
5	Art & Science of Utilisation of Electrical Energy	H. Pratab	Dhanpat Rai & Sons
6	Utilisation of Electric Power & Electric Traction	J. B. Gupta	S. K. Kataria & Sons
7	Utilisation of Electric Power & Electric Traction	G. C. Garg	S. K. Khanna
8	Fundamentals of Electrical Drives	G. K. Dubey	Narosa Publishing House
9	Modern Electric Traction	H. Pratab	Dhanpat Rai & Sons

B) Software/Learning Websites

1. sonaversity.org

C) Major Equipments/ Instruments with Broad Specifications

1. All experiments are visit based hence no additional equipments are needed.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H	M		M		L				
CO2		L		H							
CO3		M								L	
CO4		M			H						L
CO5		H			L						

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Energy Management (EEM) **COURSE CODE** : 6433

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

The consumption of energy is increasing day by day which causes imbalance in energy generation and its consumption. Energy conservation is a scientific tool provided to minimize the energy imbalance. This is one of the rapid emerging field in the area of electrical engineering hence this has been included as applied technology course.

Essential theoretical and practical knowledge about the concept of energy conservation, energy management and different measures of energy conservation to reduce energy losses and wastage in residential, commercial and industrial sectors are targeted. The topic on energy audit will be a useful tool to participate in energy conservation program of the nation.

2.0 COURSE OBJECTIVES:

The student will be able to

1. List causes for limited growth of conventional energy sources and limitations of nonconventional sources of energy.
2. Suggest methods of energy conservation for different load conditions.
3. Select appropriate tariff system and methods for reducing electricity consumption and energy saving.
4. Know the effects of power factor on energy conservation
5. Apply tools for energy audit and recommend measures for energy conservation.

3.0 COURSE OUTCOMES:

The course should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

1. Identify the demand supply gap of energy in Indian scenario.
2. Carry out energy audit of an industry/Organization.
3. Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.
4. Select appropriate energy conservation method to reduce the wastage of energy
5. Evaluate the techno economic feasibility of the energy conservation technique adopted.
6. Operate the energy audit equipment for energy audit.
7. Interpret the IE rules in energy audit process.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Tariff**	1a. Describe the objectives and characteristics of tariff 1b. Explain the various types of tariffs. 1c. Know the relation between tariff and energy conservation.	1.1 Objectives of tariff 1.2 Desirable characteristics of tariff 1.3 Types of tariff- Simple tariff, flat rate tariff, block rate tariff, two part tariff, M. D. tariff, power factor tariff, Time-off-day tariff, Peak-off-day tariff, Load factor tariff 1.4 Introduction to Availability Based	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		Tariffs (ABT) 1.5 Recent MSEDCL tariffs for different consumers. (Numerical on above topic)	
Unit-II **Power Factor Improvement**	2a. Understand the causes and effect of low power factor 2b. Explain the Methods of power factor improvement 2c. Explain the terms associated with fuse and circuit breaker. 2d. Describe most economical power factor and state importance of improvement.	2.1 Introduction to power factor 2.2 Causes of low power factor 2.3 Effects of low power factor 2.4 Methods of power factor improvement (Numerical on above) 2.5 Most economical power factor 2.6 Importance of power factor improvement	08
Unit-III **Energy Conservation Basics**	3a. Know the current energy availability 3b. State need of energy conservation and audit with its benefits 3c. Explain role of BEE and know energy saving promoting organisations. 3d. Explain Energy conservation Act 2001	3.1 Review of various energy sources 3.2 Indian Energy Scenario 3.3 Need of energy conservation and Energy audit. 3.4 Energy Conservation and its importance 3.5 Role of Bureau of Energy Efficiency in energy conservation 3.6 Star Labelling of equipments 3.7 Energy conservation Act 2001 3.8 Energy Units and Conservations 3.9 Functions of Government Organization (NPC, MNRE, BEE, MEDA).	10
Unit-IV **Energy Conservation in Lighting**	4a. State the basics terms related to lightning 4b. Know the energy assessment steps in lightning and different energy saving techniques. 4c. Explain different energy conservations techniques in lightning scheme. 4d. Describe the inrush current phenomenon in transformer. 4e. Identify the conservation technique in fan	4.1 Basic terms used in lighting system (Illumination). 4.2 Recommended Luminance levels 4.3 Procedure for assessing existing Lighting system in a facility. 4.4 Energy Conservation techniques in lighting system. • By replacing Lamp sources. • Using energy efficient luminaries. • Using light controlled gears. • By using the advance technology • By installation of separate transformer / servo stabilizer for lighting. • Periodic survey and adequate maintenance programs. • Energy Conservation techniques in fans, Electronic regulators.	10
Unit-V	5a. Know the construction and process of power	5.1 Construction, Power flow and working of Induction motor.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Energy Conservation Techniques in Electrical Motors	flow in motor. 5b. State the factor consider for motor selection 5c. Describe the various techniques of energy conservation in induction motor 5d. Describe Energy Efficient motors	5.2 Factors governing the selection of Induction motor. 5.3 Need for energy conservation in Induction motor. 5.4 Various energy conservation techniques in Induction motor. • By improving Power quality. • By motor survey. • By matching motor. • By minimizing the idle and redundant running of motor. • By operating in star mode. • By rewinding of motor. • By improving mechanical power and transmission efficiency. 5.5 Energy Efficient motors.	
Unit-VI **Energy Conservation Equipment**	6a. Know the purpose of energy conservation equipment. 6b. Describe the energy conservation equipments in lightning system. 6c. Explain the energy conservation equipments in electrical motors. 6d. Describe working energy conservation equipments in T&D system.	6.1 Introduction of energy conservation equipment. 6.2 Energy conservation equipment related to Lighting system. • Centralized Control Equipment (Microcontroller based). • Occupancy sensors/Motion Detectors. • Control gears: Dimmers, Regulators and Stabilizers). 6.3 Energy conservation equipment related to electrical motors: Construction, working and advantages of each energy conservation Equipment listed below: ▪ Soft starter: For induction motors ▪ Power Factor Controller ▪ Static capacitor ▪ Automatic star delta starter ▪ Variable Frequency Drives. 6.4 Energy conservation equipments in T&D system: • Maximum Demand Controller • kVAR Controller • Automatic Power Factor controller.	10
Unit-VII **Energy Audit**	7a. State the Electricity act 2003 and IE rules for energy audit. 7b. Describe energy flow diagram and state its importance. 7c. Use of various energy audit instruments for measurement.	7.1 Electricity act 2003 (statement) 7.2 IE rules and regulations for energy audit. 7.3 Energy Flow Diagram and its significance. 7.4 Energy audit instruments and their use. 7.5 Questionnaires for the energy audit. 7.6 ABC analysis.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	7d. Prepare energy audit questionnaire 7e. Know the stepwise procedure of different energy audits. 7f. Calculate the payback period and return on investment of energy conservation measures.	7.7 Internal energy audit checklist. 7.8 Procedure of Energy audit (walk through audit and detailed energy audit) 7.9 Simple payback period and return on investment 7.10 Examples on small Energy conservation projects. (Numerical).	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Tariff	04	02	02	08
II	Power Factor Improvement	04	04	02	10
III	Energy Conservation Basics	04	04	--	08
IV	Energy Conservation in Lighting	04	06	04	14
V	Energy Conservation Techniques in Electrical Motors	04	06	04	14
VI	Energy Conservation Equipment	04	06	04	14
VII	Energy Audit	04	04	04	12
	TOTAL	**28**	**32**	**20**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Collect the energy bills of various electrical consumers and prepare a report on reduction of electricity bill.	02
2	II	Visit to Automatic power factor correction unit in industrial / commercial utility understand its working.	04
3	III	Study the information about energy conservation act from IEA 2003.	02
4	III	Prepare a report on role and functions of Energy Manager and Energy Auditor in area of energy sector.	02
5	IV	Collect information by market survey and prepare report on rating, luminous output, cost, list of manufacturers of various types of energy efficient luminaries (FTL, CFL, LED, Sodium Vapour, HPMV etc.)	04
6	IV	Make a comparative study of energy efficient control gears and ballasts used in lighting system on the basis of energy efficiency, cost,	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
		life, energy saving and saving in energy bill	
7	IV	Case study on the energy conservation measures taken in street lightning of Municipal Corporation.	04
8	V	Case study on the energy conservation techniques implemented in electrical motors.	02
9	VII	Visit to any organization and prepare questionnaires for implementation energy conservation program. (Hospitals, workshops, institutes, commercial building, residential building etc.).	04
10	VII	Prepare a small case study report of energy audit for Residence, Small workshop, Public Library etc. by using various energy audit instruments used for measurement of electrical, mechanical and thermal energy parameters.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect from market the catalogues of star labelling domestic appliances.
2. Visit the web site of BEE and MEDA collect the information on energy conservation activities.
3. Take the interview of the energy manager regarding to energy conservation.
4. Prepare a presentation on the possible measures of energy conservation for different consumers.
5. Collect list different Manufactures of energy saving equipments.
6. Collect list different suppliers of energy saving equipments.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration of energy conservation in air-conditioning system.
2. Arrange a visit to roof top solar plant to understand the working of solar generation.
3. Arrange expert seminar of industry person in the area of energy saving technology.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Principles of Power System	V. K. Mehta	S. Chand & Co.
2	Guide Books no. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors (Fourth Edition 2015)	(BEE)	Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India)
3	India - The Energy Sector	P. H. Henderson	University Press
4	Energy Management Handbook	W. C. Turner	Wiley Press
5	Energy Management and Conservation	K. V. Sharma, P. Venkataseshaiah	I K International Publishing House Pvt. Ltd; First Edition, Edition-November 2011.
6	Utilization Generation & Conservation Of Electrical Energy	Sunil S. Rao	Khanna Publishers (rs) (2007)
7	Energy Management, Audit and Conservation	Barun Kumar	Vrinda Publications P Ltd.; 2e edition (28 April 2014
8	Switchgear and Protection	Gupta J. B.	Katariya Publication New Delhi

B) Learning Websites

1. Website of bureau of energy and efficiency: www.bee-india.nic.in
2. Website of Akshay Urja News Bulletin: www.mnes.nic.in

3. Maharashtra Energy Development Agency (MEDA):www.mahaurja.com
4. Notes on energy management on: www.energymanagertraining.com
5. www.greenbusiness.com
6. www.worldenergy.org

C) Major Equipments/ Instruments with Broad Specifications

1. Energy Measuring and auditing equipments (power meter, PF Frequency Lux meter, speedometer, Thermometer gas analyser, stroboscope and smart energy meters.
2. Different types Fluorescent lamp, Sodium/ Mercury vapour lamp/ CFL and LED lamps etc.
3. APFC Panel.
4. VFD Drive with the motor.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1	L	H									
CO2		M			H						
CO3				H							
CO4						H					
CO5										H	
CO6					H						
CO7							H				

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Microcontroller and Applications (MCA) **COURSE CODE** : 6529

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

An electronics/electrical engineer working in an industry are required to make use of micro controller programming for various applications. The objective of this course is to enable the student to use micro controller for variety of industrial application. The technology of microprocessor has led to a single chip Microcontroller technology. MCS- 51 family architecture, details of 8051 Microcontroller and its assembly and C programming is covered in this course. This will help to Student in developing innovative solutions to particular industrial problems or to emerge as an entrepreneur.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Compare Microprocessor and Microcontroller.
2. Describe architecture and operation of microcontroller 8051.
3. Develop assembly language programs using instruction set of 8051.
4. Understand the use of high level language (C programming) to develop programs for 8051 microcontroller.
5. Interface peripheral with microcontroller 8051.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Select appropriate version of microcontroller for different application.
2. Use Software Simulator/program development tool.
3. Write and execute assembly language program/C program for specific application.
4. Interface input/output peripherals with microcontroller 8051.
5. Develop small microcontroller based application.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of Microcontroller**	1a. Compare between microprocessor and microcontroller. 1b. Differentiate between microcontroller architectures. 1c. Compare versions of microcontrollers. 1d. Explain generalized block of microcontroller.	1.1 Introduction to microcontroller. 1.2 Comparison of Microprocessor& Microcontroller. 1.3 Evolution of Microcontroller. 1.4 Terminology: RISC, CISC, Harvard and Von-Neumann Architectures and their comparisons. 1.5 Generalized functional block diagram of microcontroller. 1.6 Specification & comparison of 8051, 8751 & 8951	08

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **8051 Microcontroller Architecture**	2a. State features of 8051 microcontroller. 2b. Draw pin diagram and architecture of 8051. 2c. Explain pin functions and architecture of 8051. 2d. Explain Concept of Stack and Stack Pointer. 2e. Draw and explain register format of TMOD, TCON registers. 2f. State and explain the function of various 8051 Interrupts.	2.1 Features and Pin diagram with function of all pins of 8051. 2.2 Architecture of 8051. 2.3 Function of program counter and data pointer, A and B registers, Program status word (PSW) register, concept of Stack and stack pointer register, I/O ports, SFR's 2.4 Internal Memory: Concept and Structure of 128 byte internal RAM, Structure of 4kb EPROM. 2.5 Timers and Counters: Study of Timer SFR's (TMOD, TCON, TLX, THX), Timer modes of operation. 2.6 Interrupts: Interrupt sources, IE and IP SFR map, Interrupt Priorities.	16
Unit-III **Addressing modes and instruction set**	3a. State and explain 8051 assembler directives, Data types. 3b. Identify addressing Modes of instructions. 3c. Explain functions of all assembly instructions of 8051. 3d. Develop assembly language program for different operations.	3.1 Instruction syntax and data types: Opcode, Operand, label, comment and assembler directives such as DB, ORG, EQU, END, Data types and data range. 3.2 8051 Addressing modes-Definition and types. 3.3 8051 Instruction Set: Data transfer, Arithmetic, Logical, Branch-jump & Call Instructions, Bit manipulation instructions. 3.4 Simple Programming: 8-bit addition, subtraction, multiplication, division, Average of 8-bit numbers, largest number, smallest number, ascending order, block transfer, Program to demonstrate use of subroutine.	16
Unit-IV **8051 Programming Using C**	4a. State and explain various C data types. 4b. Use different software simulators. 4c. Develop C program for desired application using 8051.	4.1 C data types: unsigned/signed char, unsigned/signed int, sbit, sfr. 4.2 Software Simulators of 8051(MIDE-51, Keil's Tool, µvision debugger). 4.3 C Programming: LED Blinking, Read input port and send hex data to output port, Display 0 to 9 BCD number on Seven Segment Display.	08
Unit-V **Peripheral Interfacing and Programming**	5a. Draw Interfacing diagram of peripheral with 8051 such as ADC, DAC, LEDs, 7-segment, LCD, DC & Stepper Motor. 5b. Develop assembly	5.1 ADC 0808/0809 interfacing & programming 5.2 DAC 0808 Interfacing -Generation of Square wave, Triangular wave. 5.3 Interfacing & programming of LEDs. 5.4 Interfacing and programming of 7-segment display.	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	language program to use peripheral with 8051 such as ADC, DAC, LEDs, 7-segment, LCD, DC & Stepper Motor.	5.5 LCD interfacing- Initialization, programming. 5.6 DC & Stepper motor interfacing with Programs. (All Interfacing related programs are to be developed using 8051 Assembly programming).	
Unit-VI **8051 Interfacing applications**	6a. Draw interfacing diagram of Temperatures sensor, Relay and Servo motor with 8051. 6b. Explain interfacing of various peripherals with 8051.	6.1 Interfacing applications (programming not expected) • Temperature measurement using LM35 temperature sensor. • Relay and opto-isolator interface • Servo motor control	04
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basics of Microcontroller	04	04	00	08
II	8051 Microcontroller Architecture	08	10	04	22
III	Addressing modes and instruction set	04	08	08	20
IV	8051 Programming Using C	02	02	04	08
V	Peripheral Interfacing and Programming	02	06	08	16
VI	8051 Interfacing applications	02	04	00	06
	TOTAL	**22**	**34**	**24**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1.	II	Study of Pin diagram and architecture of 8051.	02
2.	III	Develop and execute assembly language program using simulator for 8-bit addition and 8-bit subtraction.	04
3.	III	Develop and execute assembly language program using simulator for 8-bit Multiplication and Division.	04
4.	III	Develop and execute assembly program using simulator for Addition of 10 nos. stored in internal memory of 8051/52 and store the result in next two locations.	02
5.	III	Develop and execute assembly program to find largest/smallest number from group of 10 numbers using simulator.	04
6.	III	Develop and execute assembly program to arrange 5 numbers in ascending order using simulator.	02
7.	III	Develop and execute assembly program to transfer 10 numbers from external memory to internal memory using simulator.	02
8.	V	Develop, execute and download on kit assembly program to interface stepper motor and to rotate it in clockwise and anticlockwise direction.	02
9.	V	Develop, execute and download on kit assembly program to interface (16x2) LCD and display message on it.	04
10.	V	Develop, execute and download on kit assembly program to interface DAC0808 and Generate Square waveform.	02
11.	IV	Develop, execute and download on kit 'C' program (8051) to interface and blink LEDs on I/O ports.	02
12.	IV	Develop, execute and download on kit 'C' program (8051) to interface 7-segment and display BCD-counter on it.	02
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Prepare a chart of architecture of 8051.
2. Prepare a chart showing all instructions of 8051.
3. Prepare chart to represent the interfacing diagram of microcontroller with different Peripherals.
4. Prepare/Download a dynamic animation to illustrate the following Data transfer operation
   a. LCD Interfacing
   b. Stepper / DC Motor Interfacing

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video/animation film to demonstrate the working of microcontroller.
2. Arrange expert lecture of a person in the area of Microcontroller.
3. Arrange visit to relevant industry.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	The 8051 Microcontroller Architecture, Programming and Application	Kennneth J. Ayala	Thomson & Delmar Learning. (PRI), Second Edition.
2	The 8051 Microcontroller and Embedded systems	Mazidi, Mazidi & Mckinlay	Pearson Publication, Second Edition.
3	Microcontrollers	Ajay Deshmukh	Tata-McGraw Hill Publication, first Edition.

Sr.No.	Title of Book	Author	Publication
4	Programming and customizing the 8051 microcontroller	Myke Predko	Tata-McGraw Hill Publication 1999.
5	Exploring C for microcontrollers- A hands on approach	J. S. Parab, V.G. Shelake	Springer
6	Programming and customizing the 8051 microcontroller	Myke Predko	Tata-McGraw Hill Publication 1999.

B) Software/Learning Websites

1. www.8052.com
2. www.nptel.iitm.ac.in

C) Major Equipments/ Instruments with Broad Specifications

1. 8051 Microcontroller Trainer Kit.
2. 8051 Simulator Software (Web version)
3. Computer system (Latest version)
4. Peripheral interface kits
5. 8051 microcontroller programmer.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1	L		H								
CO2	L			H						L	
CO3	L	M								H	L
CO4	M	L								L	
CO5	L		H								M

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Industrial Automation and Control (IAC) **COURSE CODE :** 6530

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Automation plays a major role in industries. In order to understand and perform the duties of an Engineer, an Electrical Engineering student should have knowledge of PLC, SCADA, DCS and control system components. Skills regarding basics of PLC Programming, Industrial Controllers will be covered, so that after studying this course student will be able to perform duties like supervising, controlling & maintaining the control systems.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the significance of automation.
2. Know PLC architecture with block diagram and functions of components used.
3. Apply rules for logic diagram development for different applications.
4. Explore the areas of application for hydraulic systems & Pneumatics systems in control and automation.
5. Understand the working of electrical actuators like synchros, servomotors, potentiometers and tachogenerators for control applications.
6. Use industrial control components and build power & control circuits for applications.
7. Get acquainted with Controllers, types, their action and advanced control systems.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Identify need and appreciate the importance of automation.
2. Familiar with functions of components used in PLC.
3. Develop logic diagram for industrial application by applying basic rules.
4. Differentiate hydraulics systems, Pneumatics Systems for performance.
5. Select proper electrical actuators for control applications.
6. Use input and output devices and build power and control circuits for applications.
7. Compare controllers on the basis of action and Know advanced control systems SCADA and DCS.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Automation**	1a. Explain significance of automation 1b. State advantages of automation 1c. Differentiate Relay based & PLC based control system	1.1 Importance of Automation 1.2 Types of Automation 1.3 Advantages of Automation 1.4 Comparison between Relay based and PLC based control systems.	04
Unit-II	2a. Draw generalized block diagram of PLC	2.1 Block diagram and working of PLC 2.2 PLC Advantages and	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Programmable Logic Controllers	2b. Draw simple block diagrams and functions of different input modules 2c. Know type and use of memory 2d. Compare PC and PLC 2e. Develop block diagram of PLC power supply.	Disadvantages 2.3 Types of PLC-Fixed and modular 2.4 Comparison between PC and PLC 2.5 Scan cycle of PLC 2.6 PLC specifications 2.7 PLC Modules-digital input modules & their ratings 2.8 Analog input models & ratings 2.9 Timer/counter modules 2.10 Memory: Types of memory and their functions 2.11 PLC Power supplies- block diagram and function of each block	
Unit-III **Basics of PLC programming**	3a. Know names of PLC Programming languages 3b. Understand Ladder diagram development 3c. Use of logic diagram for industrial applications	3.1 PLC programming languages 3.2 Ladder diagram development ▪ Concept of ladder diagram ▪ Rules/Conventions of ladder diagram 3.3 Classifications of PLC instructions-bit type, logical, comparison, timer, counter, scaling instructions 3.4 Industrial Process examples-Bottle filling plant, Diesel generator set control, Motor Control, Traffic light control, stepper motor control	10
Unit-IV **Hydraulic and Pneumatic Systems**	4a. Know fundamentals of hydraulic system and Pneumatics systems 4b. Familiarize with working of components used in both systems 4c. List control devices used for systems & know control process 4d. Applying control action in hydraulic and Pneumatic systems	4.1 Review of fundamentals and features of Pneumatics and Hydraulic systems 4.2 Components of hydraulics and Pneumatics systems with their working 4.3 Control devices of above Systems 4.4 Examples of Hydraulic Systems 4.5 Examples of Pneumatic Systems	10
Unit-V **Electrical Actuators**	5a. Understand use of potentiometer, synchros as error detector 5b. Understand working of servomotor, tachogenerator for control applications architecture for smart grid 5c. State working of tachogenerator 5d. Operate stepper motor for various step angles 5e. Apply control devices for applications	5.1 Potentiometers – working and use as error detector 5.2 Servomotors –ac and dc working principle 5.3 Synchros –transmitter, control Transformer, Use as error detector. 5.4 Tachogenerator-working Principle, features 5.5 Stepper Motor-working, types And control of step angle 5.6 Applications of above components in control System.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-VI **Industrial Control Components and Power Circuits**	6a. Use input devices such as push button, limit switches etc. In industrial machine control 6b. Use output devices such as relays, contactors, solenoid valves etc. in industrial control 6c. Draw symbols used in power and control circuits 6d. Develop power and control circuit for examples like crane, hoist, conveyor belt applications	6.1 Input devices- Push buttons, selector switches, solenoid valves, limit switches, foot switch, proximity switch, temperature actuated, level control, pressure operated switch 6.2 Output devices-Electromagnetic relays, contactors, Solid state relays, Latching relays, Bimetallic thermal overload relay, Time delay relay, Electronic overload relay, pneumatic cylinders, pilot lamps, valves 6.3 Symbols used in industrial control circuits 6.4 Power and control circuits for Crane, conveyor belt	10
Unit-VII **Control Actions and Advanced Systems**	7a. Know working of controller actions 7b. Draw block diagram of each controller P, PI, D, PID & function 7c. Differentiate various controllers	7.1 Block diagrams and brief functions of various controllers such as- Proportional Controllers, Integral Controllers, Proportional Integral Controllers, derivative controllers, Proportional-Integral-derivative Controllers. 7.2 Comparison & advantages 7.3 SCADA, DCS Block diagram, working, hardware and software used in brief	08
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Automation	-	04	02	06
II	Programmable Logic Controllers	04	06	06	16
III	Basics of PLC Programming	02	04	08	14
IV	Hydraulics & Pneumatic Systems	-	06	04	10
V	Industrial Control Components and Power circuits	02	04	06	12
VI	Electrical Actuators	04	04	04	12
VII	Control Actions and advanced Control systems	02	04	04	10
	TOTAL	**14**	**32**	**34**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Approximately Hours required
1	V	Draw Symbols used in electromagnetic control circuit diagrams	02
2	I	Develop ladder diagrams for logic gates OR and, NOT, XOR	04
3	III	Develop ladder diagrams for traffic light control system	04
4	VI	Demonstrate and analyse step variation for a stepper motor in forward and reverse direction	04
5	VI	Demonstrate and analyse positions of load with DC position servo mechanism	04
6	V	Draw power and control circuit diagrams for Semi-automatic & Fully Automatic Star-Delta Starter	02
7	V	Observe operation and working of different types of switches, relays used in motor control circuits (pushbuttons, limit switches, relays in visit to automated plant	02
8	VII	Observe SCADA/DCS operation in process plant and understand the block diagram with components used	06
9	II	Collect data from market- PLC brands and manufacturers	02
10	IV	Draw symbols for different components of hydraulic systems and Pneumatic systems	02
		TOTAL	**32**

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Information search on PLC specifications from leaflets, brochures and websites
2. Prepare collection of diagrams, functions of different types of switches, relays, timers, contactors, solenoids, sensors, pilot lamps, valves
3. Draw symbols of components used to create ladder diagrams

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any)

1. Industrial/Field visits
2. Expert Lectures
3. Video presentation
4. Workshops on automation, PLC Programming
5. Assignments

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Programmable Logic Controllers-principles and applications	Webb & Reis	Prentice Hall India
2	Programmable Logic Controllers	John R. Hackworth & Frederick, Hackworth	Pearson

Sr.No.	Title of Book	Author	Publication
3	Industrial electronics and control (including Programmable Logic Controller) [3rd edition only]	Biswanath Paul	Prentice Hall India
4	Control of Electrical Machines	S. K. Bhattacharya Brijinder Singh	New Age International Publishers
5	Industrial Control Engineering	Jacob	Prentice Hall
6	Hydraulics & Pneumatics	Andrew Parr	Jaico Publication
7	Control System Engineering	Nagnath Gopal	Wiley Eastern
8	Handbook of Electric Motor Controls	Eshwar U. S.	Tata McGraw Hill
9	Electronics Instrumentation	H.S. Kalsi	Tata McGraw Hill

B) Software/Learning Websites

1. www.brothersoft.com/download/plc-simulator.com
2. www.edusoft.co.za/ladsim.htm

C) Major Equipments/ Instruments with Broad Specifications

1. DC Position Control system
2. PID Control System Trainer
3. AC Position Control System Trainer
4. Logic control simulation model for PLC
5. Elevator Control Module for PLC
6. Stepper Motor control module for PLC
7. PLC Trainer Kit
8. Stepper motor kit
9. PLC Programming Software
10. Synchro transmitter receiver pair

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		H			M						
CO3		H			M						
CO4		M									
CO5		M									
CO6				H						L	
CO7				H						L	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Advanced Power System (APS) **COURSE CODE :** 6531

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Due to developments in electrical power system field, it has become necessary to know requirements of complex power system, smart grid concept, power quality impact on industrial as well as domestic consumers. Diploma students of power system course should have an insight into latest trends of power system advancements, act. These students should be aware of FACTS devices and deregulation and use of fiber optics for power system communication.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the concepts of stability, reliability and security of power system.
2. Know nature of power quality problems and suggest remedial measures.
3. Understand the meaning of deregulation
4. Comprehend smart grid technology and its applications.
5. Adopt suitable power system communication methods and trends
6. Get acquainted with various reactive power compensation methods.
7. Know fiber optic communication technology

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. State power system requirements with regard to stability, reliability & security
2. Identify power quality problem and provide solution
3. Use electricity act 2003 for reforms and restructuring of power sector
4. Apply smart Grid concept for developing smart cities.
5. Select appropriate method for reactive power compensation
6. Compare methods of communication in power system
7. Aware of latest trend of fibre optic communication for power system

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Power System - Requirements**	1a. Explain concept of stability, types of stability 1b. Describe significance of power system Reliability and power system security	1.1 Concept of system stability, steady state stability & transient stability and dynamic stability 1.2 Power System Reliability 1.3 Power system Security	08
Unit-II **Power Quality**	2a. State importance of Power quality 2b. List and define various Power quality attributes. 2c. Mention sources of disturbances 2d. Explain effect of power	2.1 Importance of power Quality studies. 2.2 Introduction to Power quality attributes.(Definition as per IEEE 519) -Voltage Sag, swell, flicker, unbalance, transient, notches,	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	quality attributes on power system. 2e. Suggest remedies for reduction in harmonics.	harmonics, interruptions 2.3 Sources of power quality disturbances 2.4 Effects of harmonics for industrial applications 2.5 Effects of harmonics for domestic applications 2.6 Introduction to Power quality improvement methods	
Unit-III **Deregulation**	3a. Define Deregulation and state its importance 3b. State and Explain in brief Salient features of The Electricity Act 2003 3c. Explain Roles of GENCO, TRANSCO, DISCO	3.1 Significance of deregulation in power system 3.2 Structure of deregulated industry ▪ Generation company (GENCO) ▪ Transmission company (TRANSCO) ▪ Distribution company (DISCO) 3.3 Retail Service Company 3.4 Salient features of The Electricity Act 2003 3.5 Open Access 3.6 Unbundling of state Electricity Board	14
Unit-IV **Smart Grid**	4a. Understand the concept of smart grid 4b. Develop architecture for smart grid 4c. State merits, demerits and applications for smart grid 4d. Know status of smart grid in India.	4.1 Concept of Smart Grid 4.2 Smart grid-Architecture, Standards and applications 4.3 SCADA-Smart metering 4.4 Smart grid Indian Scenario	10
Unit-V **Reactive Power Control**	5a. State the meaning of SIL 5b. Justify the need of reactive power control 5c. Enlist and explain methods of reactive power compensations.	5.1 Surge impedance loading of transmission line 5.2 Various reactive power compensators 5.3 Introduction to FACTS, FACT Devices	08
Unit-VI **Power System Communication**	6a. Identify the methods of communication in power system 6b. Appreciate the roles and functions of NLDC, , RLDC, LDC 6c. Understand the working of SCADA system. 6d. Awareness of Recent trends in power system communication	6.1 Introduction to Communication in power system 6.2 NLDC, RLDC, LDC, SCADA System –Block Diagram and Working 6.3 Introduction to Fibre optic communication for power system	10
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Power System -Requirements	04	04	02	10
II	Power Quality	04	08	08	20
III	Deregulation	02	08	08	20
IV	Smart grid	02	04	06	10
V	Reactive Power Control	02	04	04	10
VI	Power System Communication	02	04	04	10
	TOTAL	**16**	**32**	**32**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignments/tasks should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the competencies.

Sr. No.	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Approximately Hours required
1	I	Visit to 400 kV Grid Substation and understand Power system operation reliability and security	06
2	II	Measurement of power quality disturbances in institute/site by power quality analyzer	04
3	III	Prepare report on Deregulated power system in Maharashtra	04
4	IV	Understanding SCADA Systems by field visit	06
5	IV	Draw the layout of smart city using smart grid concept	04
6	V	Understand FACTS devices and FACTS systems in India and prepare report.	04
7	VI	Observe the working of Fiber optics communication in power system and prepare report	04
		TOTAL	**32**

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.*

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Information search on working of SLDC, RLDC, LDC
2. Data collection of utility of smart grid in smart cities.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (if any)

1. Industrial/Field visits
2. Expert Lectures
3. Video presentation

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title	Author	Publications
1	Elements of electrical power station design	M. V. Deshpande	Wheeler Publication
2	Switch gear & Protection	S. Rao	Khanna Publication
3	Modern Power system Analysis	Nagrath Kothari	Tata McGraw Hill
4	Elements of power system	Steavenson	Tata McGraw Hill
5	Power Quality	Dugan	McGraw Hill
6	Introduction to FACTS	Hingorani	IEEE Press
7	Power Quality	Heydit G.T.	Star of Circle Publications

B) Software /Learning Websites

1. http://www.nrel.gov/
2. www.icrepq.com
3. www.nptel.ac.in
4. http://www.smartgrid.gov
5. smartgrid.ieee.org

C) Major Equipments/ Instruments with Broad Specifications

Power quality analyser : 3-Phase 4-Wire Power Quality Analyzer Compliant to IEC61000-4-30 Class 'A' Standards with Dynamic 1300V Range, Harmonic and Inter-harmonics Analysis Capabilities Class 'A' PQA • Monitor and record power quality • 1P2W to 3P4W + additional input (AC/DC 1ch) • Clamp input, Power Quality software compliant with this analyzer

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		H			M						
CO3		H			M						
CO4		M									
CO5		M									
CO6				H						L	
CO7				H						L	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Traction Engineering (TRE) **COURSE CODE** : 6532

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Now days almost all over world, we are using Electric Traction for transportation. Indian Railways provide large job Potential for Diploma Electrical Engineer students hence an Electrical Engineer must know details about Electric Traction.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Know about different problems associated with single phase AC track electrification
2. Identify and explain use of components of the power supply arrangement for electric traction
3. Understand various over head equipments in electric traction
4. Know about Power Circuit, auxiliary circuit equipments of AC electric locomotive and different types of drives for electric traction and its control.
5. Know different train lighting systems, signals and track circuits
6. Understand concepts of supervisory control of traction power control

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Explain Problems associated with Single Phase AC track electrification
2. Draw layouts of various switching posts related with power supply arrangements in electric traction
3. Select and describe suitable over head equipment for electric traction
4. Describe details of AC traction rolling stock
5. Describe suitable method of controlling Traction Motors
6. Describe various train lighting systems, signals and track circuits used in electric traction
7. Explain supervisory control of electric traction power supply

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basics of Electric Traction.**	1a. Describe Various electric traction systems in India 1b. Compare various Electric Drive system used for Traction. 1c. Select proper remedy for problems associated with AC traction systems.	1.1 General description of Electrical Traction system in India 1.2 Advantages & Disadvantages of Electric Drive, Diesel Electric Drive, Battery Drive. 1.3 Problems associated with AC traction System and remedies for it. ▪ Voltage unbalance ▪ Current unbalance ▪ Production of harmonics ▪ Induction effects.	06

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-II **Power Supply Arrangements**	2a. Sketch layouts for various constituents of power supply arrangement 2b. Describe functions and specifications of major equipments used in switching stations. 2c. Describe Protective system for traction transformer and 25 kV catenary protection with layout drawing 2d. Explain various factors deciding location and spacing of traction substations.	2.1 Introduction 2.2 High voltage supply 2.3 Constituents of supply system ▪ Substation: layout, list of equipments and their functions ▪ Feeding post: list of equipments and their functions ▪ Feeding & sectioning Arrangements ▪ Sectioning & paralleling post ▪ Sub sectioning & Paralleling post ▪ Sub sectioning post ▪ Elementary section 2.4 Miscellaneous equipment at control post or switching station. 2.5 Major equipments at sub station ▪ Transformer ▪ Circuit breaker ▪ Interrupter 2.6 Protective system for traction transformer protection and 25 kV catenary protection 2.7 Location & spacing of substation	10
Unit-III **Over Head Equipments**	3a. State the types of overhead equipments 3b. Select the proper catenary as per the speed limit 3c. Explain various types of OHE supporting structure 3d. Select proper type of current collection system as the speed and current collection limit.	3.1 Different types of overhead equipments 3.2 Pentagonal OHE Catenary Construction. : ▪ Concept of Catenary wire and contact wire. ▪ Material used for the above wires. ▪ Height of Contact Wire. ▪ Contact wire Gradient. ▪ Encumbrances, Span Length. ▪ Function of Dropper. ▪ Different Types of Catenary according to speed Limit. 3.3 OHE Supporting Structure, Cantilever assembly diagram. 3.4 Current collection systems: ▪ Overhead system- Trolley collector, Bow collector, Pentagraph Collector and side rail collector, Types and construction of pantagraph.	10
Unit-IV **Electric Locomotive**	4a. Identify type of locomotive as per nomenclature 4b. Draw block diagram for AC Locomotive 4c. List various Power Circuit and Auxiliary	4.1 Classification and Nomenclature of Electric Locomotive according to Gauge, type of supply, type of services 4.2 Block diagram of AC locomotive 4.3 Power Circuit of AC Locomotive. - Diagram and list of Equipments in	09

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	circuit equipments and their functions in AC locomotive 4d. State the meaning of various locomotive Bogie arrangements 4e. List the activities to be carried out related with locomotive maintenance	power circuit i.e. Pantograph, Circuit breaker, Traction Transformer, Rectifier, Smoothing Choke Traction Motor. Functions of each Equipment 4.4 Equipments (List and Function only) used in auxiliary circuit of AC Locomotive: Arno Converter, all types of blowers, exhausters, compressors, blower motors, selsyn transformer, static battery charger. 4.5 Loco bogie classification according to wheel arrangement like B-B, BO-BO, CO-CO 4.6 Maintenance of AC locomotive 4.7 Need for maintenance, Electrical faults and their Causes, Operations to be carried out before and after overhaul. Only Name of the tests to be carried out on individual Loco motive equipments.	
Unit-V **Traction Motors**	5a. Select suitable traction motor type as per their characteristics 5b. Calculate Starting Efficiency for series parallel control 5c. Explain various traction motor control methods with circuit diagrams 5d. Explain principles of various latest traction control methods.	5.1 Desirable characteristics of traction motor. Suitability of motor for traction 5.2 DC series Motor 5.3 AC series Motor 5.4 3phase induction motor 5.5 Linear induction motor 5.6 Control of DC traction motor by Series parallel control method. energy saving in it, Numerical based on it., Transition methods 5.7 Tap Changer Control 5.8 Thyristor Control ▪ Thyristor Control on AC Side (Brief Introduction) ▪ Thyristor control on DC Side (Brief Introduction) 5.9 Introduction to VVVF control Method for Induction motor	04
Unit-VI **Braking**	6a. State Sequence of Braking in Electric Traction 6b. Explain working of different types of mechanical braking systems 6c. Describe various electrical braking system and its suitability for DC Series traction motor	6.1 Requirement of Braking 6.2 Sequence of Braking 6.3 Types of Braking: a. Mechanical braking (Short introduction about compressed air and vacuum braking system) b. Electric braking system: Rheostatic braking and Regenerative braking. Suitability of DC Series motor for regenerative braking.	09

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	6d. Calculate amount of energy feed back to supply during regenerative braking	Derivation and numerical for amount for energy feed back to system during regenerative braking	
Unit-VII **Train Lighting**	7a. State various systems and special requirements of train lighting systems 7b. List possible reasons for failure of under frame generating equipments 7c. State advantages of EOG system over self generation coach system 7d. Explain rail way coach air conditioning system	7.1 Systems of Train Lighting. 7.2 Special Requirements of Train Lighting. 7.3 Method of obtaining Unidirectional Polarity. 7.4 Method of obtaining Constant Output. 7.5 Single Battery System. 7.6 Double Battery Parallel Block System. 7.7 Failure of under frame Generating Equipments. 7.8 End on Generation. 7.9 Railway Coach Air Conditioning: ▪ Requirements. ▪ Types of Installations. ▪ Air Conditioned Rolling Stock ▪ Air Conditioning Equipments on Coaches.	08
Unit-VIII **Signaling**	8a. State the requirements of signalling system 8b. Enlist types of signals as per construction and their location 8c. Differentiate between various aspects of colour light signals 8d. Explain working, merits and demerits of DC and AC track circuits with circuit diagram	8.1 Requirements of Signaling System 8.2 Types of Signals. 8.3 Colour Light Signals. 8.4 Three and Four Aspects of Colour Light Signals. 8.5 Track Circuits. ▪ DC Track Circuit. ▪ AC Track Circuit.	04
Unit-IX **Supervisory Control**	9a. State advantages of remote control of traction power 9b. Compare DC and VF Signalling remote control system 9c. Explain various equipment used and their functions in Remote control system	9.1 Introduction. 9.2 Advantages of Remote Control. 9.3 Systems of Remote Control: DC versus Voice Frequency (VF) Signaling. 9.4 Remote Control System Equipment and Network. ▪ Mimic Diagram. ▪ Control Desk for TPC. ▪ Remote Control Switching Equipments. ▪ The F. M. V. F. T. ▪ Power Supply. 9.5 Controlled Station Equipments	04
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basics of Electric Traction	04	04	00	08
II	Power Supply Arrangements	04	04	02	10
III	Overhead Equipments	02	04	04	10
IV	Electric Locomotive	04	06	02	12
V	Traction Motors	02	02	04	08
VI	Braking	04	06	02	12
VII	Train Lighting	02	04	02	08
VIII	Signalling	04	02	00	06
IX	Supervisory Control	02	04	00	06
	TOTAL	**28**	**36**	**16**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
		Drawing work:	
1	II	Drawing On half Imperial sheet: Traction Substation Layout. Report on this Sheet	06
2	III	Drawing on half imperial sheet: Pentagonal OHE Catenary, Different Catenaries according to speed limit, OHE Supporting structure (Cantilever assembly and Portal), Pantograph, Cross section of Contact Wire. Report on this Sheet	06
3	IV	Drawing on Half imperial sheet: Power Circuit of AC Locomotive. Report on this sheet	08
		Visits:	
4	I	Visit to Traction Substation or feeding post (for layout and OHE) and writing a report on visit	06
5	VII & VIII	Visit to Railway Station (for signaling and train lighting) and writing a report on visit.	06
		OR (Alternative for 4 and 5)	
6	VII & VIII	Visit to Indian Railway Institute of Electrical Engineering, Nashik, Nashik Road (IRIEEN) and writing report on visit	12
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect technical data of different types of locomotive used in Indian Railway from various websites
2. Download various video clips or photographs or animation showing working of Electric Locomotive
3. Collect data related with various faults in Traction motor and their reasons
4. Collect photographs of various current collector equipments as per speed limits

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Demonstrate various equipments used in switching stations with help of photographs.
2. Demonstrate working of power circuit of AC Locomotive through animations.
3. Arrange Visit to Traction Substation/ Feeding Post/Traction Power Controller Post to demonstrate its working
4. Arrange visit to IRIEEN Institute to demonstrate Locomotive working, train lighting system working, various OHE equipment.
5. Arrange Visit to nearby railway station for demonstration of signaling system / OHE equipments
6. Arrange expert lecture of faculty from POH Bhusawal or TMW Nashik on Locomotive maintenance / Traction Motor Repairing.
7. Arrange expert lecture on latest technologies used in electric traction.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Modern Electric Traction	H. Pratab	Dhanpat Rai & Sons
2	Electric Traction	J. Upadhyay, S. N. Malhotra	Allied Publishers Ltd.
3	Viddyut Engine Parichay (In Hindi)	Om Prakash Kesari	S. P. Graphics
4	Utilisation of electrical energy	Open Shaw Taylor	Orient Longman Ltd.
5	Utilisation of Electric Power & Electric Traction	J. B. Gupta	S. K. Kataria & Sons

B) Software/Learning Websites

1. http://www.irfca.org/
2. http://www.railway-technical.Com
3. http://www.rdso.org.in
4. http://www.irieen.org.in
5. http://www.scrail.gov.in

C) Major Equipments/ Instruments with Broad Specifications

1. Models of Traction substations/feeding Post.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**
CO1		H	M								L
CO2		M		H							L
CO3			H								
CO4					H						M
CO5		H		H							
CO6			H	H	L						
CO7				M					M		H

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Illumination Engineering(ILE) **COURSE CODE** : 6533

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme								
Hrs / week			Credits	TH Paper Hrs.	Marks							
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

This course is intended to teach the students various aspects of Illumination scheme. The student will be in a position to apply principles and laws of Illumination & Illumination schemes. The student will have the knowledge of various types of lamps lighting accessories & control circuits. This course will enable student to use knowledge for preparing an Illumination scheme, requirement of the circuits, develop the skill of designing illumination scheme for specific applications. He/She will become aware of his role in adapting new changes in Illumination scheme necessitated due to technical innovations brought out by R & D in Illumination technology.

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand illumination scheme fundamentals
2. Differentiate between the various types of lamps.
3. Understand the working of different control circuits
4. Know the design procedure of indoor outdoor illumination scheme.
5. Describe the illumination procedure for special purposes.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Measure the level of Illumination.
2. Selection and application of various types of lamps
3. List of various lighting accessories of components.
4. Design a control circuit for Illumination.
5. Design Illumination schemes for various applications in residential, commercial & industrial Locations.
6. Execute Illumination scheme for residential, commercial & industrial locations.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Fundamentals of Illumination**	1a. Define basic illumination terminology 1b. Apply laws of Illumination 1c. State the importance of polar curves 1d. Explain Photometry 1e. Measure illumination level 1f. Apply standards of Illumination	1.1 Basic illumination terminology 1.2 Laws of illumination 1.3 Polar curves 1.4 Concept of Photometry 1.5 Measurement of illumination 1.6 Standards for illumination.	08
Unit-II **Lamps**	2a. State the working principles of types of lamps 2b. Appreciate the Applications	2.1 Neon Sign Tubes. 2.2 Neon Lamps. 2.3 Halogen Lamps.	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	of lamps	2.4 Metal halides 2.5 LED lamps 2.6 Lasers 2.7 Ultraviolet Lamps 2.8 HID and Arc lamps 2.9 Selection Criteria for lamps	
Unit-III **Illumination Control & Control Circuits**	3a. Know and apply the lighting intensity control methods 3b. Describe the functions of control circuit	3.1 Purpose of lighting control 3.2 Dimmer & Dimmer 3.3 Transformer & their types 3.4 Electronic Dimmer 3.5 Enhancing Lighting control. 3.6 Control circuits for lamps (refer): ON/OFF control & Illumination control.	10
Unit-IV **Illumination for Interior Applications**	4a. State the illumination standards. 4b. Design the indoor Illumination scheme	4.1 Standard for various locations of Interior Illumination 4.2 Design Techniques 4.3 Design considerations for Interior location of Residential, Commercial, Industrial premises 4.4 Design Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit.	14
Unit-V **Illumination for Outdoor Applications**	5a. Describe the outdoor illumination lighting scheme. 5b. State the level of illumination for various locations	5.1 Factory Lighting 5.2 Street Lighting (Latest Technology) 5.3 Flood Lighting 5.4 Railway Lighting 5.5 Lighting for Advertisement/Hoardings 5.6 Sports Lighting	12
Unit-VI **Lighting for Special Applications**	6a. State the special purpose illumination importance 6b. Propose the Illumination scheme for special purposes	6.1 Agriculture & Horticulture 6.2 Health Care Centers / Hospitals 6.3 Decorating Purposes 6.4 Stage Lighting 6.5 Aquariums & Shipyards 6.6 Special purpose lamps used in photography video films.	10
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Fundamental of Illumination	04	06	00	10
II	Lamps	04	06	04	14
III	Illumination control & Control circuit	04	02	06	12
IV	Illumination for Interior Applications	04	04	08	16
V	Illumination for Outdoor Applications	02	04	08	14
VI	Lighting for Special Applications	02	04	08	14
	TOTAL	**20**	**26**	**34**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	To Measure Illumination by luxmeter.	04
2	II	Collect & Study Techo-commercial information of different lamps available in market (i. e. Lamp manufacture, technical specification, cost etc.)	04
3	II	Visit to nearby lamp manufacturing industry.	04
4	III	Study the different lighting accessories required for varies types of lamps.	02
5	V	Design an Illumination scheme for a garden of medium size.	02
6	IV	Design an Illumination scheme for a conference room of medium size.	04
7	IV	Design an Illumination scheme for a workshop for fine work of medium size.	04
8	VI	Design an Illumination scheme for a medium size Hotel / Hospital /Shopping complex.	04
9	VI	Visit to study Illumination Scheme of Airport / Stadium	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect the catalogues of various luminaries manufacturing company and compare the electrical specifications.
2. Interview with illumination interior designer
3. Compare the various lamps and know the standards related to it
4. Collect the photo samples of well illuminated residential, commercial and industrial installations.
5. Know the government schemes for promoting the use of higher efficiency luminaries.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. IS 2418, 9974, 9900, 2218, 5077, 4012, 4013, 1885, 1947, 4347, 6665, 3287, 1777, 3646, 2672, 10894, 1944, 10322, 214 codes can be referred.
2. Arrange a visit to Airport/ Stadium for observing illumination scheme
3. Arrange expert lecture of a illumination interior designer

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Applied Illumination Engineering	Jack L. Lindsey	The Fairmont Press Inc.
2	Lighting Engineering: Applied Calculations	R. H. Simons, Robert Bean	Architectural Press (ISBN 0750650516)
3	Handbook of Applied Photometry	Casimer M Decusatis	Springer (ISBN 1563964163)
4	Handbook of Industrial Lighting	Butterworths, Stanley, Lyons	Butterworths
5	Lighting Control Technology and Applications	Robert S Simpson	Focal Press
6	Energy Management in Illuminating Systems	Kao Chen	CRC Press

B) Software/Learning Websites

1. www.bee-india.nic.in/ecourses.aec.edu.in
2. www.electrical4u.com

C) Major Equipments/ Instruments with Broad Specifications

1. Digital Luxmeter

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1				H							
CO2		L			H	M					
CO3		H								M	
CO4			H	L							
CO5			M		H			M			
CO6								M		H	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Power Electronics (PEX) **COURSE CODE** : 6534

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Power electronics is branch of engineering devoted to conversion & control of electric power using electronic converters based on semiconductor power switches like thyristor power transistor, power MOSFET, IGBT. The vast application area of power electronics includes power conditioner, electric lighting, power distribution, generation and transmission. This course deals with the understanding of power electronic semiconductor switches from thyristor family, AC to DC converters. This course develops cognitive and psychomotor skills in student**.**

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand the physical processes for the switching of a thyristor.
2. Know the various methods of triggering a thyristor and different gate turn-on methods.
3. Develop logic about the turning off mechanism of a thyristor and get acquainted with some methods of turning a thyristor off.
4. Become familiar with other members of the thyristor family as well as other power electronic devices.
5. Know the characteristics of different power electronic devices.
6. Know the working of rectifiers, choppers, inverters and applications of the Thyristor.

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

1. Assemble power electronic circuit
2. Trace the fault in given circuit
3. Identify faulty component in given circuit
4. Infer from the output regarding probable faults in given Circuit.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Power Semiconductor Devices**	1a. Classify different power electronic devices. 1b. Describe construction and operation of Power MOSFET, Power Diode, Power BJT, IGBT and GTO. 1c. State the applications of Power MOSFET, Power Diode, Power BJT, IGBT and GTO. 1d. Identify different power devices.	1.1 Necessity of Power conversion using solid state devices. 1.2 Applications of Power Electronics. 1.3 Symbol, constructional diagram, operating principle, V-I characteristic and applications of Power Diode, Power BJT, Power MOSFET, IGBT and GTO. 1.4 Comparison between Power Semiconductor Devices.	08
Unit-II	2a. Classify Turn ON and Turn OFF methods of SCR.	2.1 Turn ON methods of SCR : Principle of high voltage, radiation,	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Turn ON And Turn OFF Methods Of SCR	2b. Draw circuit and explain operation of R, R-C and UJT as a relaxation mode triggering circuit. 2c. Describe the concept of high voltage, radiation, thermal and dv/dt triggering. 2d. Draw circuit and explain operation of class A, B, C, D, E and F commutation method. 2e. To assemble R, R-C triggering circuit.	thermal, dv/dt and gate triggering. 2.2 Circuit diagram and operation of R, R-C and UJT triggering circuit. 2.3 SCR Turn-off process with waveforms of Voltage and Current 2.4 Circuit diagram and operation of class A, B, C, D, E and F commutation method. 2.5 SCR Specifications and Ratings: Voltage, Current, Power, Temperature 2.6 SCR selection factors 2.7 SCR testing	
Unit-III **Converters**	3a. Classify different rectifiers. 3b. Explain with the help of a waveform, principle of phase control. 3c. Derive the expression for the output voltage of single phase Halfly controlled rectifier with R and R-L load. 3d. Draw circuit diagram and explain operation of single phase Fully controlled rectifier with R and R-L load. 3e. Describe the effect of freewheeling diode. 3f. Draw circuit diagram and explain operation of three phase Bridge controlled rectifier with R and R-L load. 3g. Draw circuit diagram and explain operation of cycloconverter.	3.1 Phase Controlled Rectifier : Classification of controlled rectifiers 3.2 Circuit diagram, operation and derivation for output voltage of single phase Halfly, Fully and Bridge controlled rectifier with R and R-L load. 3.3 Circuit diagram and operation of three phase Halfly, Fully and Bridge controlled rectifier with R load 3.4 Cycloconverters: Principle of operation, input and output waveforms of midpoint and Bridge single phase cycloconverter.	12
Unit-IV **Inverters**	4a. Describe the principle of inversion and state its need 4b. Classify inverters. 4c. Draw the circuit diagram and explain the operation of single phase half bridge inverter using SCR. 4d. Draw the circuit diagram and explain the operation of series inverter using SCR. 4e. Draw the circuit diagram and explain the operation of parallel inverter using SCR.	4.1 Need of Inverter 4.2 Classification :1Ø and 3Ø inverters, Line (Natural) commutated inverters, Forced commutated inverters, Series, parallel and bridge inverters. 4.3 Series inverter: Operation of basic series inverter, Modified series inverter, three phase series inverter. 4.4 Parallel inverter: Operation of basic parallel inverter circuit. 4.5 Single phase bridge inverter: Half bridge and Full Bridge Inverter. 4.6 Voltage and frequency control of	12

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
		1Ø inverter: Necessity of control of output voltage, Methods for output voltage control: External control of DC voltage, External control of AC voltage and internal control. 4.7 Harmonic Reduction : Pulse width modulation method : Single pulse width modulation, transformer connections, using filter (LC, Resonant).	
Unit-V **Choppers**	5a. Describe principle of operation of chopper. 5b. Draw the circuit diagram and explain the operation of step up and step down chopper. 5c. Differentiate between inverter and chopper. 5d. Identify faulty component in given chopper circuit.	5.1 Chopper principle 5.2 Control techniques: Constant Frequency System, Variable Frequency System. 5.3 Classification of choppers: Class A, class B, class C, class D, class E 5.4 Commutation methods for choppers: Auxiliary commutation, load commutation. 5.5 Step up chopper 5.6 Step down chopper 5.7 Jones chopper	08
Unit-VI **Applications of Power Electronics**	6a. State basic principles of AC and DC Machines. 6b. Selection of SCR control circuit as per the requirement of application. 6c. Draw and explain circuit diagram of Static circuit breaker (DC and AC), Induction heating control, Dielectric heating control, Electric welding control, Battery charger control, Automatic street lighting circuit using SCR.	6.1 DC Drives: Speed control of DC series motor with 1Ø half and full control converter, step up and step down chopper 6.2 AC Drives: Speed control of 3Ø induction motor, Variable frequency control : Voltage source inverter, current source inverter and cycloconverter. 6.3 Other applications: Circuit diagram, operation: Static circuit breaker(DC and AC), Induction heating control, Dielectric heating control, Electric welding control, Battery charger control, Automatic street lighting circuit using SCR, Static VAR compensation system, Close loop speed control method for D C and AC servo motor.	10
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Power Semiconductor Devices	08	02	--	10
II	Turn ON and Turn OFF methods of SCR	04	08	--	12
III	Converters	04	06	02	12

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
IV	Inverters	04	08	04	16
V	Choppers	04	08	04	16
VI	Applications of Power Electronics	--	08	06	14
	TOTAL	**24**	**40**	**16**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

Note*: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of* ***Programme Outcomes/Course Outcomes in affective domain*** *as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	I	Identify different power electronic devices.	02
2	I	Plot V-I characteristics of Power Diode.	02
3	II	Assemble R triggering circuit on breadboard or PCB.	02
4	II	Assemble R-C triggering circuit on breadboard or PCB.	02
5	II	Assemble UJT relaxation oscillator triggering circuit on breadboard or PCB.	04
6	II	Assemble the circuit of Class C commutation method on breadboard or PCB.	04
7	III	Observe the output of single phase halfly controlled rectifier with R-L load on CRO.	02
8	III	Observe the output of cycloconverter.	02
9	III	Observe the output of three phase halfly controlled rectifier with R- load on CRO.	02
10	IV	Observe performance of series inverter circuit on experimental kit.	02
11	V	Observe performance of step-up chopper.	02
12	V	Observe performance of step-down chopper.	02
13	VI	Understand the speed control of DC series motor using SCR phase control and plot speed versus armature voltage characteristics.	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Download data sheets of Power MOSFET, SCR, DIAC, TRIAC, SCS, SUS, SBS, LASCR, IGBT and GTO.
2. Collect data about prices of power devices from local market.
3. Build R- triggering circuit for SCR.
4. Collect catalogues of AC and DC drives from market. Do comparative study.
5. Collect data sheets of AC and DC motors of different ratings.
6. Conduct the market survey for industrial inverters and collect the specifications.
7. Mini project based on power electronic devices.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of power electronic devices and circuits.
2. Arrange a visit to process control industry which uses power electronic circuits.
3. Arrange expert lecture of an industry person in the area of industrial electronics.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Thyristor and its Applications	Ram Murty	PHI Learning
2	Power Electronics	P. C. Sen	Tata McGraw-Hill Education ISBN:0-07-462400-8
3	Power Electronics	M D Singh, K.B. Khanchandani	Tata McGraw-Hill Education (Second Edition) ISBN:13-978-0-07-058389-4
4	Power Electronics	M. H. Rashid	PEARSON Education, (Second Edition), ISBN:13-978-0-12-068479-7
5	Power Electronics Devices Circuits and Applications	V. R. Moorthi	Oxford University Press ISBN:13-978-0-19-567092-9
6	Industrial Electronics	G. K. Mittal	Khanna Publication

B) Software/Learning Websites

1. http://www.powerguru.org/power-electronics-design-simulation-analysis-tools
2. http://powersimtech.com/products/psi

C) Major Equipments/ Instruments with Broad Specifications

1. Cathode ray oscilloscope
2. Regulated power supply
3. Power scope
4. V-I Characteristics of IGBT – Experimental kit
5. SCR triggering using DC voltage – Experimental kit
6. SCR triggering using RC-network – Experimental kit
7. Commutation methods of SCR – Experimental kit
8. Single phase half controlled full wave rectifier with R-load– Experimental kit
9. Single phase half wave controlled rectifier with R- load – Experimental kit
10. Cycloconverter– Experimental kit
11. Series Inverter– Experimental kit
12. Time delay relay using UJT and SCR.

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H	H	M						L	
CO2		H	M		M			L			
CO3			H				L			L	L
CO4		H	H								L

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Machine Design (EMD) **COURSE CODE** : 6535

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

This course deals with design of electrical machines & equipments. The aim is to provide the basic principles useful for simple design. After completing students will be able to design DC as well as AC Machines along with skill of computer programming for design of electrical machines

2.0 COURSE OBJECTIVES:

The student will be able to

1. Understand basics of design, specific loadings & factors affecting design
2. Follow the procedure to estimate transformer design for various types
3. Apply the procedures & steps to calculate parameters in design of induction motors
4. Grade the sections of starter for slip ring induction motor
5. Know magnet coil design procedure
6. Carry out computer aided design for transformers
7. Compute parameters for design of induction motors using program

3.0 COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate some of course outcomes:

1. Know principles of design, effect of specific loadings
2. Understand detailed procedure of transformer, cooling tubes design
3. Understand steps of three Phase & Single phase Induction motor design
4. Grade the sections of starters for slip ring induction motor
5. Design magnet coils for starters
6. Use of computer programming for design of Transformers
7. Use of computer programming for design of Induction motors

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Basic Design Considerations**	1a. Know meaning of design, specifications of commonly used electrical machines 1b. Understand impact of different loadings on design of electric machine 1c. Use suitable core, winding for given application	1.1 Fundamentals of electrical design, Specifications of transformers and Induction motors 1.2 Concept of Electric loading, magnetic loading, selection of factors affecting electrical loading, magnetic loading, Specific loadings and its importance 1.3 Effect of material on design, types of windings, cores, amorphous core, its advantages	10
Unit-II **Transformer Design**	2a. Derive output equations for transformers-single phase & three phase 2b. Understand procedure	2.1 Output equation of single phase and three phase transformers-derivations 2.2 Choice of different parameters,	14

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
	to design core and yoke 2c. Estimate overall dimensions of transformers 2d. Select type of winding 2e. Calculate winding resistance, leak-age reactance 2f. Design cooling system of transformer	design of core and yoke, 2.3 Overall dimensions of single phase and three phase transformers, design of windings 2.4 Selection of type of winding for H.V. and L.V. 2.5 Calculation of resistance and leakage reactance of windings 2.6 Cooling of transformer-Methods, design, Considerations, design of cooling tubes, number of cooling tubes & their arrangement and Induction motors	
Unit-III **Design of Induction Motors-Three Phase, Single phase**	3a. Write output equation for single phase and three phase induction machines 3b. Select specific loading for design 3c. Design stator winding 3d. Design air gap, rotor slots 3e. Estimate rotor design conductor design, no. of slots	3.1 Output equation of induction motor with nomenclature used 3.2 Choice of specific electric loading, specific magnetic loading, main dimensions of stator 3.3 Design of stator Winding, no. of turns, no. of stator slots and number of conductors. 3.4 Calculation of length of air gap. 3.5 Selection of rotor slots, rotor Turns 3.6 rotor current, area of rotor 3.7 Conductor for squirrel cage induction motors	14
Unit-IV **Design of Starters for Slip ring motors**	4a. Know procedure of grading of starting resistances for three phase slip ring induction motor 4b. Understand soft starter and state merits	4.1 Grading of starting resistances for three phase slip ring induction motor 4.2 Concept of soft starter, Merits of soft starter	06
Unit-V **Design of Magnet Coil**	5a. Know roles of hold on magnet and overload magnet in starter design 5b. Understand design procedure of hold on magnet and overload magnet	5.1 Functions & requirements of hold on magnet and overload release of starter 5.2 Design of hold on coil and overload coil for starter	06
Unit-VI **Computer Aided design of Transformers and Induction motors**	6a. Develop program for computer aided design of three phase induction motor 6b. Develop program for transformer design 6c. List merits of computer aided design	6.1 Procedure & program development for computer aided design of three phase induction motors 6.2 Develop program for given Three phase Transformer 6.3 Merits of computer aided design	14
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Basic design Considerations	02	08	--	10
II	Transformer design	--	08	12	20
III	Design of Induction Motors-Three phase, single phase	04	06	10	20
IV	Design of starters for slip ring motors	--	04	08	12
V	Design of magnet coil	--	04	04	08
VI	Computer aided design of Transformers & Induction Motors	--	04	06	10
	TOTAL	**06**	**34**	**40**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6.0 ASSIGNMENTS/PRACTICALS/TASKS:

The tutorial/practical/assignment/task should be properly designed and implemented with an attempt to develop different types of cognitive and practical skills **(Outcomes in cognitive, psychomotor and affective domain)** so that students are able to acquire the desired programme outcome/course outcome.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in the mapping matrix for this course. Faculty should ensure that students also acquire Programme Outcomes/Course Outcomes related to affective domain.*

Term work will consist of drawing sheets on following sheets with report on design problem solution. (Any four)

Sr. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	II	Design of Three Phase distribution Transformer with cooling tubes	04
2	III	Design Three Phase Slip ring Induction Motor & draw sectional view	06
3	III	Design of Single Phase Induction Motor	06
4	IV	Design starter for slip ring induction motor	06
5	VI	Compute the main dimensions and all design features of stator, rotor, air gap in computer aided design for slip ring induction motor	06
6	VI	Use computer design method to design Three phase distribution transformer	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Collect specifications of Three Phase Transformers (distribution & Power)
2. Collect specifications of Three Phase Induction motors & Single Phase Induction motors.
3. Information Search on Energy Efficient motor design Considerations
4. Prepare list of materials with properties for amorphous core, new trends in winding materials
5. Observe manufacturing & design procedure in Induction motor and transformer manufacturing industries
6. Collect leaflets, brochures, data sheets for transformer, induction motors

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show and get acquainted with computer software related to design.
2. Arrange a visit to Manufacturing industries for transformer, induction motors.
3. Arrange expert lectures of industry persons in the area of electrical design of electrical machines and equipments

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	A course in Electrical Machine design	A.K. Sawhney	Dhanpat Rai
2	Conventional and Computational Aided design of Electrical Machines	K.G. Upadhyay	Galgotia
4	Design of rotating Electrical Machines	Juha Pyrhonen, Tapani Jokinen, Valeria, Hrabovcova	Wiley
5	Design of Electrical Machines	K.G. Upadhay	New Age International
6	Principles of Electrical Machine Design	R.K. Aggarwal	S.K. Kataria

B) Software/Learning Websites

1. www.cs.toronto.edu/
2. http://www.mag-inc.com
3. http://www.elprocus.com/transformer-design
4. www.electrical4u.com
5. www.cesc.co.in

C) Major Equipments/ Instruments with Broad Specifications

1. Computer PC with windows latest version
2. C Programming software license copy

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2		H			M						
CO3		H			M						
CO4		M									
CO5		M									
CO6				H						L	
CO7				H						L	

H: High Relationship, M: Medium Relationship, L: Low Relationship.

PROGRAMME : Diploma Programme in Electrical Engineering (EE)
COURSE : Electrical Drives and Control (EDC) **COURSE CODE** : 6536

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme				Examination Scheme							
Hrs / week			Credits	TH Paper Hrs.	Marks						
TH	TU	PR				TH	TEST	TH+TEST	PR	OR	TW	TOTAL
04	--	02	06	03	Max.	80	20	100	--	25	25	150
					Min.	32	--	40	--	10	10	--

1.0 RATIONALE:

Now a day Electrical drives plays a major role in industries. In order to understand and perform the duties of an Engineer an Electrical Engineering student should have knowledge of basic Electrical Derives & their control systems. After studying this course he or she will be able to perform their duties like supervising, controlling & maintaining the Electrical Drives & their control systems.

2.0 COURSE OBJECTIVES:

The student will be able to:

1. Understand the various performances from characteristics of motors.
2. Know the different starting techniques of motors
3. Describe the Electrical Drives and its applications.
4. Understand operation of the converter, chopper fed dc drive.
5. Understand the operation of both classical and modern induction motor drives.
6. Know the selection criteria for motor drive.

3.0 COURSE OUTCOMES:

The course should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

1. Explain the parameters and characteristics of motors.
2. State different starting & breaking methods of AC & DC motors
3. Describe the operation and components of electric drives.
4. Demonstrate operation of converter chopper fed drive.
5. Distinguish various speed control techniques of induction motor drives.
6. Select the drives for any particular application.

4.0 COURSE DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Unit-I **Motors and their Characteristics**	1a. Identify specification and define parameters of motors 1b. Discuss the various curve related to operational conditions 1c. Understand the characteristics Motors.	1.1 Specifications of Motors 1.2 Insulation used for Motors 1.3 Classes of duty 1.4 Temperature rise: Heating and Heating and cooling curves 1.5 Rating of Motors 1.6 Types of Motors 1.7 Electrical characteristics of DC Motors 1.8 Electrical characteristics of AC Motors. 1.9 Types of enclosures for motors.	08
Unit-II	2a. Identify and state operation of starters	2.1 Introduction to conventional starters of DC Motor and three	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Starting and Breaking of Motors	for DC motors 2b. Explain the Methods Starting of DC motor 2c. Describe the thyristorised starting for AC Motors. 2d. Explain the Electric breaking of DC and Induction Motor	phase induction motors. 2.2 Starting of DC Motor: Thyristors and the resistance starter, Thyristor starting without resistance 2.3 Induction Motor thyristor starting 2.4 Synchronous Motor starting: An inverter for starting 2.5 Electric breaking of DC and Induction Motor.	
Unit-III **Electrical Drives**	3a. Understand the concept of electrical drives. 3b. State benefits of electrical drives. 3c. Distinguish the AC and DC drive organisations. 3d. Explain four quadrant operation of drive 3e. Classify the load torque and explain drive operation at constant torque and power.	3.1 Definition, Advantages of electrical drives, 3.2 Components of Electric drive system, 3.3 Types of Electrical Drives (DC & AC). 3.4 Motor-Load Dynamics, 3.5 Speed Torque conventions and multi quadrant operation, Equivalent values of drive parameters. 3.6 Load Torque Components, Nature and classification of Load Torques, Constant Torque and Constant Power operation of a Drive.	12
Unit-IV **Solid state control of DC Motors**	4a. Describe operation of choppers. 4b. Explain the different control techniques. 4c. Distinguish various control of converter. 4d. Implement the DC motor position control.	4.1 Review of Thruster converters and DC choppers 4.2 Phase controlled inverter 4.3 Regeneration by phase control 4.4 Integral cycle control 4.5 Chopper Control 4.6 Position control by DC motors.	12
Unit-V **Solid State Control of Induction Motor**	5a. State classification of inverter configuration 5b. Describe the inverter control circuit and methods of commutation. 5c. Explain the 3-phase cycloconverter working 5d. Describe speed control techniques of induction motor	5.1 Classification of inverters 5.2 Inverter commutation methods 5.3 Inverter frequency control 5.4 Voltage control of thyristor 5.5 Harmonic elimination 5.6 Choice of thyrister three phase inverters 5.7 Inverter control circuitry 5.8 Phase controlled 3-phase to 3-phase cycloconverter 5.9 Comparison of cycloconverter and DC link converter 5.10 Induction Motor speed control 5.11 Controlled slip induction Motor drive 5.12 Concepts of VVVF control Scheme	12
Unit-VI **Selection of**	6a. Implement the selection criteria for motors	6.1 Introduction 6.2 Selection criteria of motors, Selection Factors motor duties,	10

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics	Hours
Motor for industrial drives.	6b. Describe Electric drives applications. 6c. Discuss the motor duties, inverter duty.	inverter duty motors. 6.3 Electric drives for textile application 6.4 Electric Motors for machine tool application 6.5 Electric drives for cranes 6.6 Electric Motors for compressor drives and water supply 6.7 Electric motors for power station auxiliaries and rolling mills	
TOTAL			**64**

5.0 SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Unit No.	Unit Title	Distribution of Theory Marks			
		R Level	U Level	A and above Levels	Total Marks
I	Motors and Their Characteristics	04	02	02	08
II	Starting and Breaking of Motors	04	04	04	12
III	Electrical Drives	04	04	02	10
IV	Solid state control of DC Motors	08	04	06	18
V	Solid State Control of Induction Motor	08	06	06	20
VI	Selection of Motor for industrial drives.	02	04	06	12
	TOTAL	**30**	**24**	**26**	**80**

Legends: R = Remembrance (Knowledge); U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6.0 SUGGESTED EXERCISES/PRACTICALS

Sr.No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
1	I	Plot characteristics of DC Shunt motor a) Torque –Current b) Speed – Current c) Torque – Speed	02
2	I	Plot characteristic of DC Series motor a) Torque – Current b) Speed – Current, c) Torque - speed.	04
3	II	Plot Torque–Speed characteristic of three phase induction motor.	04
4	V	Demonstrate slip energy recovery schemes	02
5	IV	Perform Speed Control of DC Shunt Motor	04
6	IV	Observe working of De Morgan's chopper	04
7	V	Speed control of three-phase induction motor by stator voltage control.	04
8	V	Speed control of three phase Induction Motor using Cyclo converter	04
9	VI	Speed control of single phase induction motor by using V/F Control	04
		TOTAL	**32**

7.0 STUDENT ACTIVITIES:

Following is the list of proposed student activities like

1. Search web information to list out the components of AC and DC drive and its specification.
2. Make comparative analysis between the AC and DC drive technology.
3. Collect information on drive technology used in inverter, washing machine and air conditioner

4. Collect list different Manufactures of electric drive controller.

8.0 SPECIAL INSTRUCTIONAL STRATEGIES (If any):

1. Show video demonstration of real drive operation.
2. Arrange an industrial visit to observe the operation of electric drive.
3. Arrange expert seminar of industry person in the area of electric drive technology.

9.0 LEARNING RESOURCES:

A) Books

Sr.No.	Title of Book	Author	Publication
1	Electric Motor Drives Modeling Analysis and Control	R. Krishanan	PH Publications
2	Fundamentals of Electrical drives	Gopal Kumar Dubey	Narosa Publishing House
3	A First Course on Electrical Drives	S.K. Pillai	Google book (online)
4	Electric Drives	Ion Boldea, Syed A. Nasar, Ion Boldea	CRC Press
5	Electric Machines	D. P. Kothari, I. J. Nagrath	Tata McGraw-Hill Education

B) Major Equipments/ Instruments with Broad Specifications

1. DC Shunt motor set with loading arrangement.
2. DC Series motor set with loading arrangement
3. Three Phase Induction motor set with loading arrangement
4. VFD Drive set with the motor
5. Chopper with Control circuitry

C) Learning Websites

1. nptel.ac.in/courses/108104011/
2. www.completepowerelectronics.com/
3. www.electrical4u.com/electrical-drives
4. www.electricdrive.org

10.0 MAPPING MATRIX OF PO'S AND CO'S:

Course Outcomes	Programme Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
CO1		H									
CO2			H			L					
CO3				H							
CO4				H							
CO5			H								
CO6				H							

H: High Relationship, M: Medium Relationship, L: Low Relationship.

Annexure : I

Rules for Registration and Examination

Important Rules of Registration for courses.

1. An eligible student must register to minimum three courses and maximum seven courses during each term.
2. While registering for a course at the beginning of a term, a student shouldn't have backlog of more than seven courses of any term as carried over due to failure or any other reason.
3. A student can register for a Project work only after acquiring minimum 100 credits.
4. A student will have to re - register for a course/s if he / she is detained from the course/s for any reason.

Important Rules regarding Registration for Examination

1. A student can register for examination of only those courses for which he has registered and kept term.
2. A student can register for examination for not more than 10 courses in one examination.
3. A student will have to re-register for examination of theory or Practical / oral of a course if he / she fails in examination.
4. A student will be allowed to re-register for examination in accordance with rules if he / she was eligible to appear for last Examination but he/ she failed to appear last examination for any reason.
5. A student will not be able to cancel his registration after he / she is Registered for examination

Other Important Rules

1. A candidate will be eligible for the award of diploma when he / she acquires the required number of credits for a Programme.
2. No candidate will be allowed to appear for examination of any course unless the Head of the Department certifies that
   2.1 Attended at least 75% of the prescribed lecture hours, tutorial hours, practical hours or any other kind of work and or assignment for the course as the case may be in conformity with the provision laid down in the course contents.
   2.2 Satisfactorily completed specified laboratory practical, term work prescribed in curriculum for the course.
3. No candidate will be permitted to reappear to any course of any examination in which he has once passed.

Standard of Passing

1. Theory, total of theory and periodic test, practical, oral and termwork examination shall be separate head of passing.
2. To pass examination of any course, a candidate must obtain a minimum of 40% marks in each head of passing prescribed for that course taken separately.

Periodic Test

1. Two periodic tests will be conducted during each term for the courses as per their examination scheme.
2. Average marks of the two period tests will be considered for each course separately.
3. Reappearing for the periodic test for improvement of marks is not allowed.

Term Work

1. Term work is a document submitted by the candidate consisting of report of site / field visit and / or laboratory work and / or drawing sheets / sketch books / jobs / model. Such term work shall be submitted before the end of academic term and it shall be satisfactory in the opinion of concern faculty member, Head of the Department and Principal of Institute.

Grace Marks

1. Grace marks shall be applicable if the rules of "standards of passing" are fulfilled.
2. The grace of maximum three marks will be given in either in "Theory marks", or "Periodic test" or "total of theory and periodic test marks", if it falls short by maximum three marks to pass a course.
3. The grace of maximum three marks shall not be applicable twice for the same course. i.e. for "theory" and "total of theory and periodic test" of same course.
4. The grace marks are not applicable to practical, oral, term work examination.

Award of Class

First Class with Distinction	:	70% or more
First Class	:	60% and above but less than 70%
Second Class	:	50 % and above but less than 60%
Pass Class	:	40% and above but less than 50 %

Annexure : II

Evaluation Scheme for Project

Term Work : Max. Marks : 50 Min. Marks : 20.
Oral : Max. Marks : 50 Min. Marks : 20.

Progressive Assessment

Name of the student: Enrolment No.:
Term : II / III ODD / EVEN
Programme: Electrical Engineering
Course : Project **Code :** 6412 **Project Guide :**

Title of Project :

SN	Project Activities	Date / Week	Leader ship	Understanding	Observation &Accuracy	Contribution	Timely Completion	Total	Signature of Student	Signature of Guide	Signature of HOD
			5	5	5	5	5	25			
1	Formation of team & finalization of project	1									
2	Submission of synopsis : by each group	2									
3	Project activity plan	3									
4	Maintenance Project Diary	6									
5	Visits to Industries / Institutions / Market	7									
6	Collection of Data / Survey	9									
7	Analysis and Presentation of data.	10									
8	Pre submission seminar	13									
9	Presentation of Rough Work : hand written	14									
10	Final Project Report : Submission	15									
	Total by Internal : out of 250										

The Term Work : Convert the total given by internal to "out off 25".

Signature of Project Guide

Project assessment :

Term Work			**Oral**		
Internal	External	Total	Internal	External	Total
25	25	50	25	25	50

Annexure : III

Committees

1. Governing Body (GB)

Sr. No	Name & Office Address	Governing Body Designation
1.	**Shri. Pramod Naik** Joint Director, Directorate of Technical Education, M.S. Mumbai	Chairman
2.	**Shri. Mahendra Kothari** Chairman, Maharashtra State Pipe & Allied Industry, D-5, MIDC Satpur, Nashik.	Member
3.	**Shri. Ashok Katariya** Chairman, Ashoka Group of Companies, Ashoka House, Ashoka Marg, Nashik.	Member
4.	**Dr. Ramesh Unnikrishnan** Regional Officer and Director, Regional Office, (AICTE) Regional Office, Western Region, Mumbai.	Member
5.	**Shri. B. S. Joshi** The Joint Director, Industries, Regional Office, Nashik	Member
6.	**Shri. V. D. Patil** Coordinator, NITTR-Bhopal Extension Center, Pune.	Member
7.	**Shri. S. P. Wagh** Chairman, Consumer Grievances Redressal M.S.E. Dist.Co.Ltd, Nashik	Member
8.	**Shri. Kishor Patil** Institute Of Career & Skills, 3, Adgaonkar plaza basement, ABB circle, Mahatma Nagar, Nashik-422007	Member
9.	**Shri. Harishankar Banerjee** President, NIMA, MIDC, Satpur, Nashik.	Member
10.	**Shri. F. A. Khan** Principal, Govt. Polytechnic, Aurangabad.	Member
11.	**Shri. Manish Kothari** Chairman, Institution of Engineers Nashik Local Centre, Nahik.	Member
12.	**Prof. Dnyandeo P. Nathe** Principal, Government Polytechnic, Nashik	Member Secretary

2. Board of Studies (BOS)

Sr. No.	Name & Office address	BOS Designation
1	**Shri. S. P. Wagh** Chairman, Consumer Grievances Redressal M.S.E. Dist.Co.Ltd, Nashik	Chairman
2	**Shri. Sunil Bhor** Project Management Consultant, 659/A wing second floor market, Shopping complex Dindori Road, Nashik.	Member
3	**Shri. Bhalchandra R. Patwardhan** Plot No.24, Atharva Raw House, Bhavik Nagar, Gangapur Road, Nashik-13.	Member
4	**Shri. Kishor T. Patil** Institute Of Career & Skills, 3, Adgaonkar plaza basement, ABB circle, Mahatma Nagar, Nashik-422007.	Member
5	**Shri. Kishor Vyas** Digilog System Pvt. Ltd., 15, Shriram sankul, Opp. Hotel Panchavati, Vakilwadi, Nashik.	Member
6	**Shri. Chandrashekhar. B. Dahale** F1, Computer Service, No. 2, Sukhraj, Near Parijatnagar bus stop,Nashik 422005	Member
7	**Shri. M. M. Dube** Sr. Executive, Systems, M & Q, C-1, MIDC, Ambad, Nashik-10	Member
8	**Shri. Anant Tagare** Principal Engineer, Validation, Mahindra & Mahindra Ltd., R & D Centre, 89, MIDC, Satpur, Nashik-422007	Member
9	**Shri. Aaush Potdar** Director, Poddar Clothing Industries, Nashik.	Member
10	**Shri. Vijay Sanap** Architect & Consultant, Soham Constructions, Nashik.	Member
11	**Shri. Pramod U. Wayse** Deputy Secretary (T), MSBTE, Regional Office, Osmanpura, Aurangabad-431005.	Member
12	**Shri. P. T. Kadve** Principal, K.K. Wagh Polytechnic, Nashik.	Member
13	**Shri. R. N. Vaidya** HOD, Civil Engg., Govt. Polytechnic, Nashik.	Member
14	**Shri. S. R. Deshkukh** HOD, Civil Engg (II Shift), Govt. Polytechnic, Nashik	Member
15	**Dr. C. Y. Seemikeri** HOD, Mechanical Engg., Govt. Polytechnic, Nashik.	Member
16	**Dr. Sanjay Ingole** HOD, Mechanical Engg (II Shift), Govt. Polytechnic, Nashik	Member
17	**Shri. J. B. Modak** I/C, HOD, Plastic Engg., Govt. Polytechnic, Nashik.	Member
18	**Shri. L. S. Patil** I/C, HOD, Elect. Engg., Govt. Polytechnic, Nashik.	Member

Sr. No.	Name & Office address	BOS Designation
19	**Shri. Yogesh Sanap** I/C, HOD Info. Tech. & Comp. Tech., Govt. Polytechnic, Nashik.	Member
20	**Shri. A. S. Laturkar** HOD, Electronics and Telecommunication Engg., Govt. Polytechnic, Nashik.	Member
21	**Dr. S. D. Pable** HOD, Electronics and Telecommunication Engg (II Shift), Govt. Polytechnic, Nashik	Member
22	**Shri. T. G. Chavan** I/C, HOD, Automobile Engg., Govt. Polytechnic, Nashik.	Member
23	**Ms. T. J. Mithari** I/C, HOD, Dress Design & Garment Manufacturing, Govt. Polytechnic, Nashik	Member
24	**Ms. N. P. Adke** I/C,HOD, Interior Design & Decoration, Govt. Polytechnic, Nashik	Member
25	**Shri. V. H. Chaudhari** I/C, Training & Placement Officer, Govt. Polytechnic, Nashik	Member
26	**Shri. G. G. Wankhede** Controller of Examination, Govt. Polytechnic, Nashik.	Member
27	**Shri. S. P. Dikshit** Lecturer in Civil Engg., I/C CDC, Govt. Polytechnic, Nashik	Member Secretary

3. Programme wise committee(PWC)

Sr. No.	Name & Office address	PWC Designation
1	**Shri. Laxmikant S. Patil** HOD, Electrical Engineering Dept., Govt. Polytechnic, Nashik.	Chairman
2	**Shri. Milind D. Dhake** Dy. Manager, Crompton Greaves, Ambad MIDC, Nasik.	Member (Industry)
3	**Smt. Vaishali S. Jogalekar** Asst. Engineer, MSEDCL, Nashik.	Member (Industry)
4	**Shri. Jitendra M. Patil** HOD, K. K. Wagh Polytechnic, Chandori, Nashik.	Member
5	**Dr. Dilip D. Lulekar** Lecturer, Electrical Engineering Dept., Govt. Polytechnic, Nashik.	Member
6	**Dr. Sanjay V. Bhangale** Lecturer, Electrical Engineering Dept., Govt. Polytechnic, Nashik.	Member
7	**Smt. Deepali R. Kirtane** Lecturer, Electrical Engineering Dept., Govt. Polytechnic, Nashik.	Member
8	**Shri. Pramod U. Wayse** Deputy Secretary (T), MSBTE, Regional Office, Osmanpura, Aurangabad 431005.	Member
9	**Shri. Sanjay P. Dikshit** Lect., Civil Engg. Dept., Incharge CDC, Govt. Polytechnic, Nashik.	Member secretary

4. PROGRAMME CURRICULUM DEVELOPMENT COMMITTEE

Institute Level Curriculum Development Cell

Sr. No.	Name of the Faculty	Designation
1	Prof. D. P. Nathe	Principal, Government Polytechnic, Nashik
2	Shri. R. N. Vaidya	Head of Civil Engineering Department and Academic co-ordinator, Government Polytechnic Nashik
3	Shri. S. P. Dikshit	CDC Incharge, Lecturer in Civil Engineering, Government Polytechnic, Nashik
4	Dr. N. L. Patil	Lecturer in Civil Engineering, Government Polytechnic, Nashik.
5	Dr. S. V. Bhangale	Lecturer in Electrical Engineering, Government Polytechnic, Nashik.
6	Dr. S. J. Gorane	Lecturer in Mechanical Engineering, Government Polytechnic, Nashik.
7	Shri. N. N. Thakare	Lecturer in Plastic Engineering, Government Polytechnic, Nashik.

Department Level Committee

Sr. No.	Name of the Faculty	Designation
1	Shri. L. S. Patil	Head of Electrical Engineering Department, Government Polytechnic Nashik
2	Dr. S.V. Bhangale	Lecturer in Electrical Engineering, Government Polytechnic, Nashik.
3	Smt. D.R. Kirtane	Lecturer in Electrical Engineering, Government Polytechnic, Nashik

NITTTR Committee

Sr. No.	Name of the Faculty	Designation
1	Prof. R. G. Chouksey	Dean Student Welfare, Department of Vocational Education and Entrepreneurship Development, NITTTR, Bhopal.
2	Dr. Nishith Dubey	Professor, Department of Vocational Education and Entrepreneurship Development, NITTTR, Bhopal.

5. Contributors to Course Curriculum Development

Sr. No.	Name of the Faculty	Designation
1	Dr. A. R. Thete	Consultant. Director Center For Development of Leadership in Education Pvt. Ltd. Aurangabad.

Sr. No.	Name of the Faculty	Designation
2	**Electrical Engineering Department, Government Polytechnic Nashik**	
	Shri. L. S. Patil	Head of Department
	Dr. D. D. Lulekar	Lecturer in Electrical Engineering
	Shri. S. S. Bhusare	Lecturer in Electrical Engineering
	Shri. S. S. Ashtaputre	Lecturer in Electrical Engineering
	Dr. S. V. Bhangale	Lecturer in Electrical Engineering
	Smt. S. S. Umare	Lecturer in Electrical Engineering
	Smt. D. R. Kirtane	Lecturer in Electrical Engineering
3	**Electronics & Telecommunication Department, Government Polytechnic Nashik**	
	Shri. A. S. Laturkar	Head of Department
	Shri. M. M. Shinde	Lecturer in Electronics Engineering
	Shri. V. B. Patil	Lecturer in Electronics Engineering
	Shri. V.S . Thakare	Lecturer in Electronics Engineering
	Shri. D. B. Borude	Lecturer in Electronics Engineering
4	**Applied Mechanics Department, Government Polytechnic Nashik**	
	Shri. R. G. Sonone	Co-ordinator and Lecturer in Applied Mechanics
5	**Mechanical Engineering Department, Government Polytechnic Nashik**	
	Shri. S. P. Muley	I/C Head of Department
	Shri. R. V. Rupavate	I/C Head of Department (second shift)
	Shri. P. S. Kulkarni	Lecturer in Mechanical Engineering
	Shri. Y. S. Kokate	Lecturer in Mechanical Engineering
	Shri. K. A. Jagtap	Lecturer in Mechanical Engineering
	Shri. A. G. Waghulde	Lecturer in Mechanical Engineering
6	**Computer Engineering Department, Government Polytechnic Nashik**	
	Shri. M. M. Goswami	Head of Information / Computer Technology Department
7	**Civil Engineering Department, Government Polytechnic Nashik**	
	Dr. S. S. Pathak	Lecturer in Civil Engineering
8	**Other Departments, Government Polytechnic Nashik**	
	Shri. P. G. Kochure	Workshop Superintendent
	Dr. K. V. Nemade	Controller of Examination, Lecturer in Automobile Engineering
9	**Science and Humanities Department, Government Polytechnic Nashik**	
	Shri. S. M. Shinde	Lecturer in Mathematics
	Mrs. A. S. Salunkhe	Lecturer in Mathematics
	Shri. C. N. Pagare	Lecturer in Chemistry
	Shri. S. A. Padwal	Lecturer in Physics
	Shri. R. P. Landage	Lecturer in English
	Mrs. A. N. Patil	Lecturer in Chemistry
	Mrs. Y. S. Patil	Lecturer in Physics
	Mrs. P. S. Joshi	Lecturer in English

Sr. No.	Name of the Faculty	Designation
	Mrs. K. S. Shinde	Lecturer in Chemistry
	Dr. Mrs. K. D. Talele	Lecturer in Physics

Certificate

The curriculum of the programme has been modified in the year 2016, as per the provision made in curriculum development process of Government Polytechnic, Nashik. This is the **outcome based Curriculum of Diploma in Electrical Engineering programme**, which shall be implemented from academic year 2016-17.

Verified by

Department Level CDC Representative
Government Polytechnic, Nashik

Head of Department
Electrical Engineering
Government Polytechnic, Nashik

Incharge, Curriculum Development Cell
Government Polytechnic, Nashik.

Principal
Government Polytechnic, Nashik.