Certificate Of BOS

This is to certify that the Curriculum Revision Document 2012 is duly approved by the honorable members of BOS and the legitimate suggestions given by them are been incorporated in this copy.

CHAIRMAN
AND
Head Of The Department
Mechanical Engineering Department

Shri. WIDOLKAR S.V.
(Hon. Member BOS)

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Scope of Diploma in Electrical Engineering

Electrical energy has now become the basic need of human being. Without electrical energy life cannot be imagined. Each and every appliance requires electrical energy. In this age of revolution in communication, the Computers, Mobile Phone, Laptop etc. Electrical energy is a basic requirement. Our day starts by switching of electrical devices.

Due to this tremendous utilization of electrical energy, it is becoming important to learn the basics of electrical energy, its Measurement, Erection of Electrical machines Commissioning, Maintenance, Generation ,Transmission, Distribution & Utilization, Safety practices etc.

This diploma in Electrical Engineering Contributes in developing Competent technicians with no of professional skills who can perform their jobs in Industry or as an entrepreneur effectively and efficiently.

In the Industry or in small business establishments, the technicians (Diploma Engineers), with necessary skills will be able to plan, erect, commission, maintain the equipments and supervise the electrical operations. The programme will develop the competencies required to troubleshoot ,repair & maintain various Electrical machines, Electrical appliances, & use of Computers in professional life.

The technician (Diploma Engineer) will also be able to work in the field of generation, transmission and distribution of Electrical energy. At the same time the diploma engineer will acquire the skills related with modern technology like Industrial control, CNC and PLC.

The diploma Engineer will also be able to provide standby supply using Non Conventional Energy resources. He can also perform energy auditing & take successful step in conservation of Energy.

This programme apart from developing the above mentioned professional skills would also develop some of the soft skills like communication skills, generic skills, and entrepreneurship skills.

AREAS OF EMPLOYMENT/ WORK

Sr. No.	Type of Industries / Organization	Designation
01	Entrepreneur	Contractor / Owner of service industry
02	Electrical installations of residential and commercial buildings	Site Supervisors/ contractor
03	Manufacturing industry	Supervisors (Middle level)
04	Service / Public sector	Marketing personnel/ Service
05	Repairing & maintenance of Electrical appliances, Electrical machines	Maintenance Engineer.

Job Functions:-

Sr. No.	Designation	Job Functions
01	Entrepreneur	*Project Management *Estimate, Procure & install necessary machinery. *Monitoring of all activities *Administer & Manage an industry *Marketing. *Keep control over production quality.
02	Site Supervisor	* Knowledge about activity of industry. * Co-ordination of staff. * Implementation of Production Planning and control in Co-ordination with other dept. * Plan, monitor and effectively Implement activities as per Policy. * Safety of men & machines. * Quality Policy.
03	Supervisor	* Get the job done from workers. * Maintenance of Machines. * Follow daily schedule. * Keep a watch on quality.

PROGRAMME AIM

- To provide a practice oriented education emphasizing execution of design plan and in-depth knowledge of the competencies required at profession.
- To develop competencies mentioned in the curriculum.

Identified competencies.

- Sufficient & updated computer literacy.
- Maintenance of electrical equipment, Machines etc.
- Knowledge of drives, PLC, microprocessor.
- Cost and safety consciousness of energy.
- Importance of energy conservation & audit.
- Knowledge of Electronics.
- Fault finding in machines & equipments.
- Communication / Presentation skill.
- Leadership & team building.
- Personality development.
- Awareness about Entrepreneurship.
- Awareness about electrical market.
- Stress management.

Salient Features of curriculum

- Competency based curriculum with modified evaluation system.
- Curriculum will develop Entrepreneurial and Generic skill among the students.
- Introduction of Electronics & Computer related subjects.
- Introduction of management & Entrepreneurship related subjects.
- New subject such as Instrumentation techniques, energy conservation & Audit etc. are introduced.
- More weightage is given to hands on skills.

STRATEGY ADOPTED FOR CURRICULUM DEVELOPMENT

Introduction

Curriculum development is a dynamic process, which is governed by the contemporary needs of the user-system. All the activities in any academic institution are guided by the curricula operating in the institution. Design of curricula and their implementation therefore requires utmost attention of one and all for its effectiveness.

It was felt that design, review / revision should be based on scientific principles of educational technology and theories of learning and it must reflect the needs, expectations and aspirations of stakeholders/clients in the technician education system. These needs of user system mainly fall in the following four domains namely.

- Personal development domain.
- Social development domain.
- Continued learning skills domain.
- Earning to live “Professional Skills “development domain.

Curriculum is designed on competency based. All competencies needed for Electrical diploma holder is first listed. Based on this structure of curriculum is prepared. Attempts have been made in this document to address to the expectations of the user system from the Diploma pass outs.

Approach to design of curriculum

This Curriculum has been designed on the systematic approach based on competency- based curriculum of educational technology and theories of learning. The data is collected in following ways.

- Feedback of alumni.
- Feedback of staff.
- Past experience of 3 years.
- Through observational records.
- By study documents used in industries, expert reports, newspapers and trade literatures etc. their views on different aspects of the curriculum.
- Through a series of discussions in programme committee.
- Through maximum use of internet.

Taking into account the knowledge, skills/ competencies, and attitudes etc. required to be possessed by the diploma pass outs the content of different courses is designed.

While designing the curriculum emphasis is given on following points.

- New/emerging technologies being used in the world of work.
- Personal values and social skills required to be possessed.
- Skills related to life-long learning and independent study.
- Professional skills required for different jobs along a career path.

Describing roles / functions of a technician.

A technician, say for example in a medium size engineering enterprise, working at middle level management position may have to carry out jobs in different departments. These are identified as

- Installation, inspection, production & control.
- Repair & maintenance.
- Marketing and sales.
- Purchase & Store.
- Observation at Site.
- Analysis, Design and Costing.
- Research & Development.

Designing content of each curriculum area.

- Different courses are categorized as.
  - Foundation Level
  - Basic Level.
  - Allied Level.
  - Applied Level.
  - Diversified Level.

- Curriculum scheme of each course along with course code is given at the beginning.
- Competencies to be developed are identified and written.
- Rationale of each course is highlighted.
- Objective of each course is highlighted and written.
- Content outline is in descriptive form. Generally the content outline of a subject was divided into chapters and then from chapters into topic outline.
- Having derived the total content outlines i.e. Theory. At the end of the theory content list of practicals is added for each course.
- Time required by a teacher to teach the prescribed theory and practical parts is mentioned.
- Number of courses per term to be taken is specified.
- Total no. of hours required to teach the entire course is mentioned.
- Total no. of lectures and practical per week is specified.
- Approach to the assessment of student's learning and types of assessment techniques to be used were decided. An assessment scheme was designed

which is suitable mix of (a) continuous evaluation of term-work (b) progressive test (c) Term end examination.

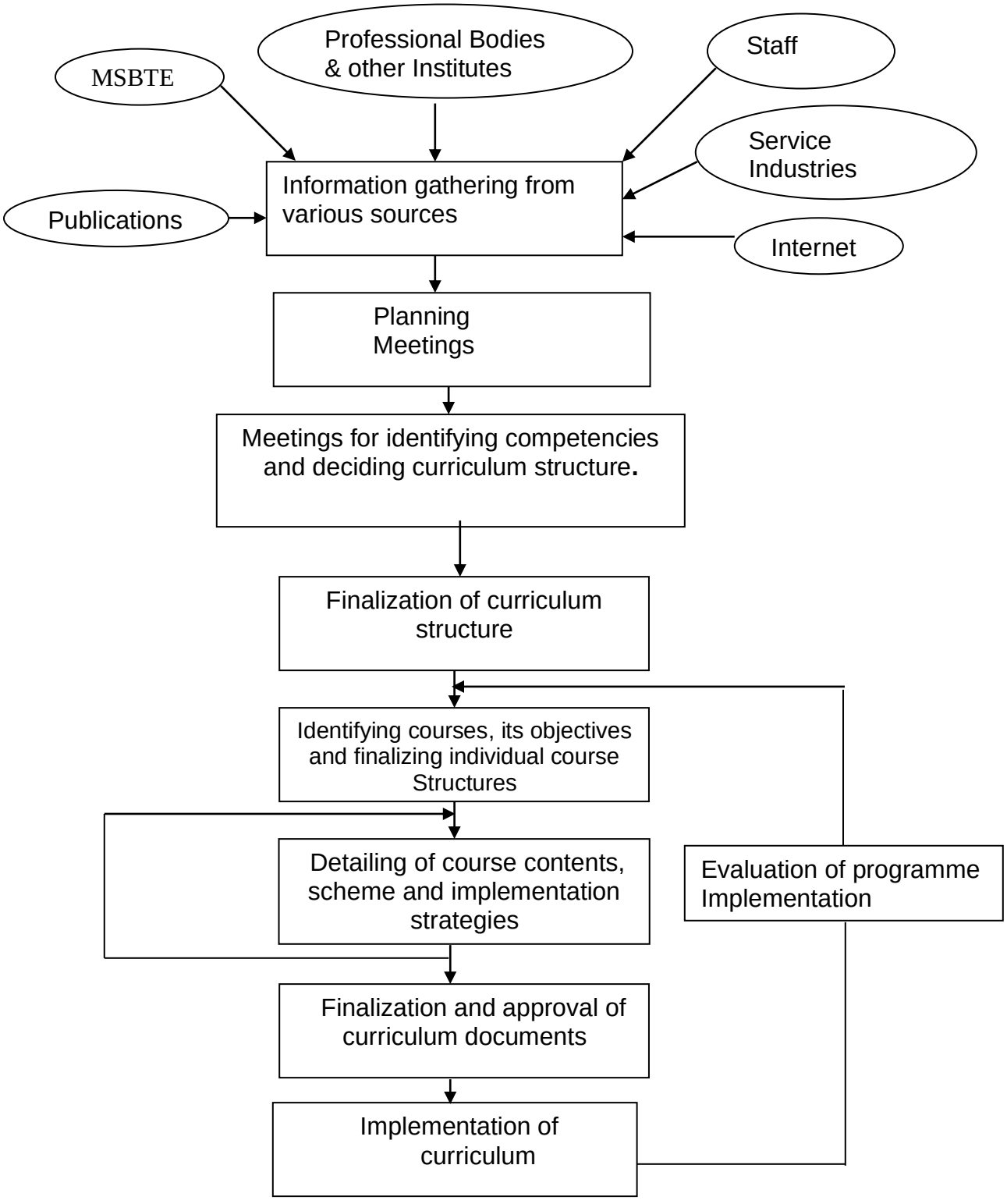
- Implementation strategies for each subject were identified.
- Learning resources for students were prescribed such as …….

  - ❖ Teacher's lecture notes.
  - ❖ Basic text-book covering most of the topics in the curriculum and other books.
  - ❖ Monographs, handbooks, periodicals, articles, journals etc.
  - ❖ Data-books, manuals, standards etc.
  - ❖ Various websites (internet)

In all these activities, views of senior teachers regarding relevance of course contents and implementation strategies being presently followed are sought.

DEVELOPING/ FINALISING A PROGRAMME STRUCTURE

Programme structure consisting of teaching and examination schemes was finally arrived at through consensus. The approach followed for curriculum development is shown diagrammatically as follows:-



PROGRAMME STRUCTURE

Sr. No.	LEVEL	Compulsory courses	Optional courses	CREDITS			MARKS		
				Comp	Opt.	Total	Comp	Opt.	Total
01	Foundation	07	---	28	---	28	750	---	750
02	Basic	07	---	34	---	34	1000	---	1000
03	Allied	05	02/15	21	04	25	550	---	550
04	Applied	12	01/04	61	06	67	1700	150	1850
05	Diversified	04	01/04	24	06	30	600	150	750
TOTAL		**35**	**04/23**	**168**	**16**	**184**	**4600**	**300**	**4900**

Scheme at a glance:

Total courses offered : 58
Compulsory courses : 35
Optional courses : 04 out of 23
Total courses : 39
Total marks : 4900

LEVEL- I (FOUNDATION LEVEL COURSES)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5G101	Basic Mathematics (BMT)	4	--	4	I	20	80	--	--	--	100
2	5G102	Engineering Mathematics (EMT)	4	--	4	II	20	80	--	--	--	100
3	5G103	Engineering Physics (EPH)	3	2	5	I	20	80	25	25	--	150
4	5G104	Engineering Chemistry (ECH)	3	2	5	II	20	80	25	25	--	150
5	5G105	Work Shop Practice (WSP)	0	3	3	II	--	--	---	50	--	50
6	5G106	Engineering Graphics (EGR)	2	2	4	I	--	--	50	50	--	100
7	5G107	Basics of Computer System (BCS)	1	2	3	I	--	--	50	50	--	100
TOTAL			17	11	28		80	320	150	200	--	750

Scheme at a glance:

Total number of courses offered : 07

Number of compulsory courses : 07

Number of optional courses : Nil

Total number of courses to be opted : 07/07

LEVEL- II: (BASIC LEVEL COURSES)

Sr. No	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5E201	Electrical Engineering (EEG)	4	2	6	II	20	80	25	25	---	150
2	5E202	Fundamentals of Electronics (FOE)	4	2	6	II	20	80	25	25	---	150
3	5E203	Electrical Measurements (ELM)	4	2	6	III	20	80	50	25	---	175
4	5E204	Network Analysis (NWA)	4	2	6	III	20	80	50	25	---	175
5	5E205	Generation & Transmission Engineering (GTE)	4	2	6	III	20	80	---	25	25	150
6	5E206	Electrical Workshop Practice (EWP)	0	2	2	III	--	--	--	50	50	100
7	5E207	Development of life skills (DLS)	0	2	2	I	---	---	--	50	50	100
TOTAL			20	14	34		100	400	150	225	125	1000

Scheme at a glance:

Total number of courses offered : 07

Number of compulsory courses : 07

Number of optional courses : Nil

Total number of courses to be opted : 07/07

LEVEL- III: (ALLIED LEVEL COURSES)

Sr. No	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5G301	English (ENG)	2	2	4	I	20	80	--	25	--	125
2	5G302	Communication Skills (CMS)	1	2	3	II	--	--	--	50	25	75
3	5G303	Entrepreneurship Development (END)	2	2	4	III	---	---	---	25	25	50
4	5G305	Industrial Management (INM)	3	2	5	IV	20	80	---	25	25	150
5	5E306	Instrumentation Technique (ITC)	3	2	5	IV	20	80	---	25	25	150
6	5G311 TO 5G325	NON EXAM (OPT)	0	2	2	II	---	---	---	---	---	---
7		NON EXAM (OPT)	0	2	2	III	---	---	---	---	---	---
		TOTAL	11	14	25		60	240		150	100	550

Scheme at a glance:

Total number of courses offered : 20
Number of compulsory courses : 05
Number of optional courses : 02
Total number of courses to be opted : 07/20

LEVEL- IV: (APPLIED LEVEL COURSES)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5E401	D.C. machines & Transformer (DMT)	4	4	8	IV	20	80	50	50	---	200
2	5E402	A.C. Machines (ACM)	4	4	8	V	20	80	50	50	---	200
3	5E403	Switchgear and protection (SGP)	4	2	6	V	20	80	---	25	25	150
4	5E404	Distribution & Utilization Engineering (DUE)	3	2	5	IV	20	80	---	25	25	150
5	5E405	Testing & Maintenance of Electrical Machines (TME)	4	2	6	VI	20	80	25	25	--	150
6	5E406	Installation, Estimation & Wiring (IEW)	4	2	6	VI	20	80	---	50	25	175
7	5E407	Power Electronics (PET)	4	2	6	IV	20	80	--	25	25	150
8	5E408	Electrical machine Design (EMD)	4	2	6	VI	20	80	---	25	25	150
9	5E409	Computer Aided Design (CAD)	0	2	2	VI	---	---	25	25	---	50
10	5E410	Project (PRJ)	---	4	4	V	---	---	---	100	50	150
11	5E411	Seminar (SMR	---	2	2	VI	---	---	---	50	50	100
12	5E412	Electrical engineering drawing and Panel wiring (EDW)	0	2	2	IV	--	--		50	25	75
Any one from												
13	5E413	Digital Techniques (DTC)	4	2	6	III	20	80	25	25	--	150
	5E414	Linear integrated circuits (LIC)										
	5E415	Design of control panels (DCP)										
	5E416	Illumination engineering (ILE)										
			35	32	67		180	720	175	525	250	1850

Scheme at a glance:

Total number of courses offered : 16
Number of compulsory courses : 12
Number of optional courses : 01
Total number of courses to be opted : 13/16

LEVEL- V: (DIVERSIFIED LEVEL COURSES)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5E501	Electrification of Building (EOB)	4	2	6	V	20	80	---	25	---	125
2	5E502	Electrical Power System (EPS)	4	2	6	VI	20	80		25	25	150
3	5E503	Energy Conservation and Audit (ECA)	4	2	6	VI	20	80	---	50	25	175
4	5E504	Non Conventional Energy Resources (NCR)	4	2	6	V	20	80	---	25	25	150
Any one from												
5	5E505	High voltage Engineering (HVE)	4	2	6	V	20	80	--	25	25	150
	5E506	Programming in C (CPR)										
	5E507	Microprocessor & Applications (MPA)										
	5E508	Thyristorised control drives (TCD)										
TOTAL			20	10	30		100	400	--	150	100	750

Scheme at a glance:

Total number of courses offered : 08
Number of compulsory courses : 04
Number of optional courses : 01/04
Total number of courses to be opted : 05/08

SAMPLE PATH (Entry Level SSC pass)

YEAR I		YEAR II		YEAR III	
ODD (I)	EVEN (II)	ODD (III)	EVEN (IV)	ODD (V)	EVEN (VI)
5G101 BMT (04+00)	5G102 EMT (04+00)	5E203 ELM (04+02)	5E306 ITC (03+02)	5E402 ACM (04+04)	5E405 TME (04+02)
5G103 EPH (03+02)	5G104 ECH (03+02)	5E204 NWA (04+02)	5E401 DMT (04+04)	5E403 SGP (04+02)	5E406 IEW (04+02)
5G106 EGR (02+02)	5G105 WSP (00+03)	5E205 GTE (04+02)	5E404 DUE (03+02)	5E410 PRJ (00+04)	5E408 EMD (04+02)
5G107 BCS (01+02)	5G302 CMS (01+02)	5E206 EWP (00+02)	5E407 PET (04+02)	5E501 EOB (04+02)	5E409 CAD (00+02)
5G301 ENG (02+02)	5G311- 5G325 Non Exam (00+02)	5G303 END (02+02)	5E412 EDW (00+02)	5E504 NCR (04+02)	5E411 SMR (00+02)
5E207 DLS (00+02)	5E201 EEG (04+02)	5G311 to 5G325 NON EXAM (00+02)	5G305 INM (03+02)	Any one from 5E505 HVE 5E506 CPR 5E507 MPA 5E508 TCD (04+02)	5E502 EPS (04+02)
	5E202 FOE (04+02)	Any one from 5E413 DTC 5E414 LIC 5E415 DCP 5E416 ILE (04+02)			5E503 ECA (04+02)
22	**29**	**32**	**31**	**36**	**34**
51		**63**		**70**	
Total credits to be completed					**184**

SEMESTER : FIRST

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5G101	Basic Mathematics (BMT)	4	--	4	20	80	--	--	--	100
02	5G103	Engineering Physics (EPH)	3	2	5	20	80	25	25	--	150
03	5G106	Engineering Graphics (EGR)	2	2	4	--	--	50	50	--	100
04	5G107	Basics of Computer System (BCS)	1	2	3	--	--	50	50	--	100
05	5G301	English (ENG)	2	2	4	20	80	--	25	--	125
06	5E207	Development of life skills (DLS)	0	2	2	---	---	--	50	50	100
TOTAL			**12**	**10**	**22**	**60**	**240**	**125**	**200**	**50**	**675**

SEMESTER : SECOND

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5G102	Engineering Mathematics (EMT)	4	--	4	20	80	--	--	--	100
02	5G104	Engineering Chemistry (ECH)	3	2	5	20	80	25	25	--	150
03	5G105	Work Shop Practice (WSP)	0	3	3	--	--	---	50	--	50
04	5G302	Communication Skills (CMS)	1	2	3	--	--	--	50	25	75
05	5G311 -- 5G325	Non Exam (Opt)	0	2	2	---	---	---	---	---	0
06	5E201	Electrical Engineering (EEG)	4	2	6	20	80	25	25	---	150
07	5E202	Fundamentals of Electronics (FOE)	4	2	6	20	80	25	25	---	150
TOTAL			**16**	**13**	**29**	**80**	**320**	**75**	**175**	**25**	**675**

SEMESTER :THIRD

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5E203	Electrical Measurements (ELM)	4	2	6	20	80	50	25	---	175
02	5E204	Network Analysis (NWA)	4	2	6	20	80	50	25	---	175
03	5E205	Generation & Transmission Engineering (GTE)	4	2	6	20	80	---	25	25	150
04	5E206	Electrical Workshop Practice (EWP)	0	2	2	--	--	---	50	50	100
05	5G303	Entrepreneurship Development (END)	2	2	4	---	---	---	25	25	50
06	5G311 -- 5G325	NON EXAM (OPT)	0	2	2	---	---	---	---	---	---
Any one from											
07	5E413	Digital Techniques (DTC)	4	2	6	20	80	25	25	--	150
	5E414	Linear integrated circuits (LIC)									
	5E415	Design of control panels (DCP)									
	5E416	Illumination engineering(ILE)									
TOTAL			**18**	**14**	**32**	**80**	**320**	**125**	**175**	**100**	**800**

SEMESTER : FOURTH

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5E306	Instrumentation Technique (ITC)	3	2	5	20	80	---	25	25	150
02	5E401	D.C. machines & Transformer (DMT)	4	4	8	20	80	50	50	---	200
03	5E404	Distribution & Utilization Engineering (DUE)	3	2	5	20	80	---	25	25	150
04	5E407	Power Electronics (PET)	4	2	6	20	80	--	25	25	150
05	5E412	Electrical engineering drawing and Panel wiring (EDW)	0	2	2	--	--	--	50	25	75
06	5G305	Industrial Management (INM)	3	2	5	20	80	---	25	25	150
TOTAL			**17**	**14**	**31**	**100**	**400**	**50**	**200**	**125**	**875**

SEMESTER :FIFTH

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5E402	A.C. Machines (ACM)	4	4	8	20	80	50	50	---	200
02	5E403	Switchgear and protection (SGP)	4	2	6	20	80	---	25	25	150
03	5E410	Project (PRJ)	---	4	4	---	---	---	100	50	150
04	5E501	Electrification of Building (EOB)	4	2	6	20	80	---	25	---	125
05	5E504	Non Conventional Energy Resources (NCR)	4	2	6	20	80	---	25	25	150
Any one from											
06	5E505	High voltage Engineering (HVE)	4	2	6	20	80	--	25	25	150
	5E506	Programming in C (CPR)									
	5E507	Microprocessor & Applications (MPA)									
	5E508	Thyristorised control drives (TCD)									
TOTAL			**20**	**16**	**36**	**100**	**400**	**50**	**250**	**125**	**925**

SEMESTER :- SIXTH

Sr. No.	Course code	Course Name	Teaching Scheme			Examination Scheme					
			Th	Pr	Cr	PT	Th	Pr	Tw	Or	Total
01	5E405	Testing & Maintenance of Electrical Machines (TME)	4	2	6	20	80	25	25	--	150
02	5E406	Installation, Estimation & Wiring (IEW)	4	2	6	20	80	---	50	25	175
03	5E408	Electrical machine Design (EMD)	4	2	6	20	80	---	25	25	150
04	5E409	Computer Aided Design (CAD)	0	2	2	---	---	25	25	---	50
05	5E411	Seminar (SMR)	---	2	2	---	---	---	50	50	100
06	5E502	Electrical Power System (EPS)	4	2	6	20	80	---	25	25	150
07	5E503	Energy Conservation and Audit (ECA)	4	2	6	20	80	---	50	25	175
TOTAL			**20**	**14**	**34**	**100**	**400**	**50**	**250**	**150**	**950**

5G101 Basic Mathematics (BMT)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	00	Max. Marks	20	80	--	--	--	100
Total credits	04	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):
To inculcate the practice of mathematic
Comprehend the principles of other subjects
Solve problems by using analytical and systematic approach**.**
The students will be able to: Develop process of logical thinking

Rationale:
The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analyze Engineering problems. Mathematics lies down the foundation to understand core technology subjects.

Contents: Theory

Chapter	Name of the Topic (Follow S.I. units)	Hours	Marks
01	**Algebra** 1.1 Logarithms 1.2 Defination natural and common logarithams. 1.3 Laws of logarithams 1.4 Simple numericals on logarithams	04	04
02	**Determinant** 2.1 Definition of Determinant, Order of Determinant 2.2 Expansion of Determinant of order 2and3 2.3 Properties of Determinant 2.4 Cramer's Rule (solution of simultaneous equations in two and three unknowns)	08	08
03	**Partial Fractions** 3.1 Definition of Partial fraction, proper and improper fractions, rational fractions 3.2 To resolve given rational fraction into partial fractions 3.3 Denominator containing non repeated linear factors 3.4 Denominator containing repeated linear factors 3.5 Denominator containing irreducible non-repeated quadratic factors	06	08
04	**Matrices** 4.1 Definition of matrix: Type of matrix: viz.- null, row, column, square, diagonal, scalar, unit, Triangular. 4.2 Algebra of matrices –addition, subtraction and multiplication		

	4.3 Transpose of a matrix 4.4 Adjoint of a matrix 4.5 Inverse of matrix by adjoint method	08	10
05	**Trigonometry** 5.1 Trigonometric ratios of allied, compound and multiple angles 5.2 Trigonometric Ratios of allied angles 5.3 Trigonometric Ratios of compound angles 5.4 Trigonometric Ratios of multiple angles Product, sum and difference formulae 5.5 Sub-multiple angles	10	16
06	**Inverse Circular Functions** 6.1 Definition of Inverse circular functions 6.2 Principle values of Inverse circular functions 6.3 Simple problems	04	08
07	**Properties of Triangles** 7.1 Sine rule, Cosine rule, 7.2 Tangent rule(without proof)Simple problems	06	06
08	**Calculus** 8.1Cartesian products of sets. 8.2Definition of relation, definition of function, real value function, domain, co-domain of a function. 8.3 Types of Functions. 8.4 Value of the function at given point. 8.5 Composite function.	08	08
09	**Limits** 9.1Definition and concept of limit, limits of algebraic functions 9.2 Limits of trigonometric functions 9.3 Limits of exponential functions 9.4 Limits of logarithmic functions	10	12

TEXT B00KS

Sr. No	Title of Book	Author and Publication
1	Mathematics for polytechnic students for first year	S.P.Deshpande
2	Mathematics for polytechnic students for first year	G.V.Kumbhojkar
3	Mathematics for polytechnics	TTTI Bhopal
4	Applied Mathematics	Gore and Patil
5	Trigonometry Part I	Loney

5G102 Engineering Mathematics (EMT)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	00	Max. Marks	20	80	--	--	--	100
Total credits	04	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):
To inculcate the practice of mathematic
Comprehend the principles of other subjects
Solve problems by using analytical and systematic approach.

Rationale:
The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analyze Engineering problems. Mathematics lies down the foundation to understand core technology subjects.

Contents: Theory

Chapter	Name of the Topic (Follow S.I. units)	Hours	Marks
01	**Derivatives** 1.1 Definition of derivative, notation. 1.2 Derivative of standard functions. 1.3 Rules of Differentiation (without proof) such as sum, difference, product and quotient. 1.4 Derivative of composite functions. 1.5 Derivative of inverse trigonometric functions. 1.6 Derivative of implicit functions. 1.7 Derivative of parametric functions. 1.8 Logarithmic differentiation. 1.9 Second order derivatives. 1.10 Simple applications of derivative such as equation of tangent & normal, maxima & minima, radius of curvature.	18	26
02	**Integration** 2.1 Definition of integration. 2.2 Integration of standard function. 2.3 Rules of Integration: sum, difference & multiplication. 2.4 Methods of Integration. 2.4.1 Integration by substitution. 2.4.2 Integration by partial fraction. 2.4.3 Integration by parts. 2.5 Definition of Definite integral. 2.6 Simple problems on definite integral	18	22

03	**Differential Equations** 3.1 Definition of differential equation, order &degree. 3.2 Formation of differential equation. 3.3 Solution of Diff. equation. 3.3.1 variable separable. 3.3.2 Homogeneous equation. 3.3.3 Exact diff. equation. 3.3.4 Linear diff. equation.	14	16
04	**Statistics** 4.1 Graphical representation: Histogram & give curve to find Mode and median. 4.2 Measures of dispersion : Range, mean deviation and Standard deviation	06	08
05	**Probability.** 5.1 Introduction & definitions of different terms permutation & combination. 5.2 Definition of probability. 5.3 Addition Theorem of probability. 5.4 Multiplication Theorem. 5.5 Conditional probability**.**	08	08

TEXT BOOKS

Sr. No.	Title	Author	Publication
1.	Mathematicsfor polytechnic students for second Year	S. P. Deshpande	Dhanpatrai publishing Co.
2.	Applied Mathematics	ByPatel & Rawal	S. Chand & Co., N. Delhi
3.	Fundamentals of Mathematical statistics	S.C.Gupta & Kapoor	Pune vidhyarti graham prakshan

5G103 Engineering Physics (EPH)

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	05	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s) : The student should be able to :
1. Analyze different factors on which accuracy depends.
2. Differentiate between scalars and vectors.
3. Describe principle and working of laser.
4. Differentiate between conductor, insulator and semiconductor on the basis of band theory

Rationale:

Physics provides foundation for core technology subjects. Understanding of any subject is entirely depending on logical thinking and hierarchy of knowledge component. As Physics is considered as basic science, its principles, laws, hypothesis, concepts, ideas are playing important role in reinforcing the knowledge of technology.

Deep thought is given while selecting topics in physics. They are different for different groups. This will provide sound background for self-development in future to cope up with new innovations. Topics are relevant to particular programme and student will be motivated to learn and can enjoy the course of Physics as if it is one of the subjects of their own stream.

Chapter	Name of the Topic	Hours	Marks
01	**Units and Measurements** 1.1 Definition of unit , requirements of standard unit, fundamental and derived quantities and their units 1.2 Definition of accuracy, precision and error, estimation of errors -absolute error, relative error and percentage error, rules and identification of significant figures. 1.3 Scalars & Vectors: Definition, laws of Vectors (Law of triangle, law of parallelogram) (Numericals on percentage error and significant figures, Law of parallelogram)	07	12
02	**Kinematics** 2.1 Angular Motion: Definition of Angular displacement, angular velocity, angular acceleration, Relation between angular velocity and angular acceleration, definition of S.H.M 2.2 Kinetics: Definition of momentum, impulse, impulsive force,	08	10

	Statements of Newton's laws of motion with equations, Application of laws of motion-Recoil of gun, Motion of two connected bodies by light inextensible string passing over smooth pulley, motion of lift. 2.3 Work power & energy: Definition of work, power & energy. Equation for potential energy & kinetic energy, work done by a torque.		
03	**General Properties of Matter** 3.1 Elasticity Deforming force, restoring force, elastic and plastic body, stress and strain with their types. Elastic limit, Hooke's law, Young's modulus, Bulk modulus, modulus of rigidity and relation between them (no derivation), (Numericals on stress, strain and Young's modulus) 3.2 Surface Tension: Molecular force, cohesive and adhesive force, Molecular range , sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I. unit, angle of contact, capillary action with examples, relation between surface tension, capillary rise and radius of capillary (no derivation),effect of impurity and temperature on surface tension (Numericals on relation between surface tension, capillary rise and radius) 3.3 Viscosity Viscous force, Definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its S.I. unit, free fall of spherical body through viscous medium (no derivation) terminal velocity, Stokes law (statement and formula). (Numericals on coefficient of viscosity and Stroke's formula)	14	20
04	**Heat** 4.1 Three modes of transmission of heat -conduction, convection and radiation, steady state coefficient of Thermal conductivity and its S.I. unit, Definition of linear, Aerial and cubical expansion and relation between them.(no derivation)	02	04
05	**Light, Laser and Sound** 5.1 Properties of light Reflection, refraction and their laws, Snell's law, physical significance of refractive index, definition of dispersion, polarization and diffraction of light along with ray diagram	06	12

	5.2 LASER Properties of laser, absorption, spontaneous and stimulated emission, population inversion, optical pumping, active system (concept and definitions) construction and working of He-Ne laser. Application of Lasers (medical and engineering) 5.3 Sound Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength , equation of progressive wave (no derivation), longitudinal and transverse wave comparison, forced and free vibrations, definition of resonance with examples, formula for velocity of sound with end correction (no derivation) (Numericals on relation v = nλ and resonance)		
06	**Electronics** 6.1 Electrostatics Coulomb's Inverse square law, Intensity of electric field, Electric lines of force & their properties, flux, flux density. Statement and general equation of Ohms law – Resistances in series & parallel Specific resistance, principle of Wheatstone bridge and Principle of potentiometer 6.2 Electric Potential and Electric Capacitance: Principles of capacitance and its units, condensers in series & parallel (numerical on condensers)	04	08
07	**Semiconductors** 7.1 Classification of conductors, insulators, Semiconductors on the basis of energy bands, p-type & n-type semiconductor, p-n junction diode, biasing of p-n junction diode(forward & reverse)	03	06
08	**Modern Physics** 8.1 Photo electricity Concept of photon**,** Plank's hypothesis, properties of photon, photo electric effect, Characteristics of photoelectric effect, work function, Einstein's photoelectric equation(no derivation), photoelectric cell - applications. **(**Numericals on Energy of photon, work function, Photoelectric equation) 8.2 X-rays Introduction to x-rays, types of x-rays production of x-rays using Coolidge	04	08

	tube, minimum wavelength of x-rays(no derivation), properties of x-rays, engineering, medical and scientific applications. (Numerical on minimum wavelength of x-rays)		

PRACTICALS

Skills to be developed

1) Intellectual skills-

_ Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.
_ Analyze properties of matter & their use for the selection of material.
_ To verify the principles, laws, using given instruments under different conditions.
_ To read and interpret the graph.
_ To interpret the results from observations and calculations.
_ To use these results for parallel problems.

2) Motor skills-

_ Proper handling of instruments.
_ Measuring physical quantities accurately.
_ To observe the phenomenon and to list the observations in proper tabular form.
_ To adopt proper procedure while performing the experiment.
_ To plot the graphs.

List of Experiments:

1) To know your Physics Laboratory.
2) To use Vernier Caliper for the measurement of dimensions of given object.
3) To use Micrometer Screw Gauge for the measurement of dimensions (Thickness, Diameter) of given object.
4) To verify Hooke's Law by Searle's method and to calculate Young's modulus of elasticity of steel wire.
5) To verify Law of Parallelogram.
6) To determine coefficient of viscosity of given fluid (Glycerin) using Stoke's Method.
7) To determine the velocity of sound by using resonance tube.
8) Determination of specific resistance by Voltmeter-Ammeter method.
9) Determination of Law of resistance in Series by meterbridge.
10) Determination of Law of resistance in Parallel by meterbridge.
11) Comparison of E.M.F by Single Cell method.

Reference books :

Sr. No.	Title	Author	Publication
1	Physics-I	V. Rajendran	TMH
2	Applied physics	Arthur Beiser	TMH
3	Engineering Physics	R.K.Gaur and S.L.Gupta	Dhanpat Rai
4	Fundamentals of Physics	Resnick ,Halliday & Walker	Wiley India
5	Applied physics	G.B. Bhandarkar	Nirali publication
6	Basic physics	Pawar and Sutar	Nirali publication
7	Basic Physics	---	S. Chand

5G104 Engineering Chemistry (ECH)

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	05	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):
The student should be able to:

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Describe the mechanism of electrolysis.
4. Identify the properties of metals & alloys related to engineering applications.
5. Identify the properties of non metallic materials, related to engineering applications.

6 Select a proper material for specific purpose.

Rationale:
Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications & selection of materials for engineering applications.

Due to technological progress there are hazardous effects on environment & human life. The core knowledge of environmental effects will bring awareness in students about the precautions & preventions to be taken to reduce the ill effects.

This subject will generate curiosity of carrying out further development in engineering field

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Atomic Structure** 1.1 Definition of Atom, element, molecule , introduction to different atomic theories, 1.2 Bohr's atomic theory, Fundamental Particles of Atom their Mass, Charge, Location 1.3 Atomic no, Atomic Mass no. numerical problems on it , orbit & orbitals 1.4 Electronic configuration , electronic configuration of first 30 elements 1.5 Isotopes & Isobars 1.6 Inert gases & their characteristics ,electronic configuration	08	10

	1.7 Molecule formation: valency, types of valiancy, electrovalency co valency. Its examples. Formation of electrovalent compounds e.g. Nacl, CaCl2, formation of Covalent Compounds H2O, Cl2, C2H4, C2H2.		
02	**Electrochemistry** 2.1 Definition & differentiation of Atom, Ion. 2.2 Ionisation & Electrolytic dissociation, Arrhenius Theory of Ionisation, Degree of Ionisation & factors affecting degree of ionization. 2.3 Introduction of Conductors, Insulators, Dielectrics, Electrolyte, Non Electrolyte, 2.4 Electrolysis, Electrolytic Cell, Electrodes. Mechanism of Electrolysis 2.5 Electrochemical Series for Cations & Anions, 2.6 Electrolysis of CuSO4 Solution by using Cu Electrode & Platinum Electrode 2.7 Faraday's first & second law of Electrolysis & numerical problems on it. Applications of Electrolysis such as Electroplating & Electro refining 2.8 Electrochemical Cells & Batteries Types of cell, Primary & secondary cell construction, Working & Applications of Dry cell & Lead – Acid Storage	06	12
03	**Metallurgy** 3.1 Definition of Metallurgy, Mineral, Ore, Gangue, Flux & Slag, Occurrence of Metals, 3.2 Mechanical Properties of metals such as Hardness, Toughness, Ductility, Malleability, Tensile strength, 3.3 Stages of Extraction of Metals from its Ores in detail i.e. Crushing, Concentration, methods of concentration (physical and chemical) 3.4 Reduction of iron in blast furnace with chemical reactions, Reactions in zone of reduction and zone of absorption, 3.5 Alloys Definition of Alloy, Purposes of Making alloy. 3.6 Methods of Preparation of alloy such as fusion method. 3.7 Classification of Alloys , Ferrous alloys & Non Ferrous alloys, their examples. 3.8 Composition, Properties & Applications of Alnico, Duralumin, Dutch Metal, German Silver / Nickel Silver, Gun Metal, Monel metal, Wood's Metal	08	14

04	**Corrosion of Metals and its Protection** 4.1 Corrosion Definition of corrosion, Types of corrosion 4.2 Atmospheric corrosion or dry Corrosion, corrosion due to oxygen , different film formation , 4.3 Immersed Corrosion or Electrochemical Corrosion, oxygen absorption Mechanism , Hydrogen evolution mechanism 4.4 Protection of Metals from corrosion. Purification of Metals from corrosion, Alloy Formation, Cathode Protection Appling Protective Coatings like metal coating by galvanising, Tinning, Electroplating.	06	08
05	**Water** 5.1 Sources of water, impurities in water, 5.2 Hard water & soft water, types of hardness, causes of hardness, 5.3 Effects of hard water in boiler, scale & sludge formation in boiler its effects on boiler, 5.4 Effects of hard water in diff. industries and domestic purposes 5.5 Softening of hard water by soda lime process, permutite process, ion exchange process, 5.6 Potable water its condition for portability, 5.7 Different methods of purification of water	07	10
06	**Non Metallic Materials** 6.1 Plastics - Definition of Plastic, Formation of Plastic by Addition Polymerisation with example such as Polyethylene 6.2 Condensation Polymerisation with suitable example such as Bakelite plastic. 6.3 Types of Plastics, Thermo softening & Thermosetting Plastic 6.4 Compounding of Plastics – Resins, Fillers, binders Plasticizers, Accelerators, Pigments etc. .Engineering properties of plastic and its related uses. 6.5 Rubber - Natural Rubber, Its Processing, Drawbacks of Natural Rubber, 6.6 Vulcanisation of Rubber with Chemical Reaction. 6.7 Synthetic Rubber its examples Buna –S & Buna –N rubber, Distinction Between Natural & synthetic rubber 6.8 Properties of rubber such as Elasticity ,Tack, resistant to abrasion, Rebound capacity. 6.9 Engineering Applications of rubber based on their properties. 6.10 Thermal Insulating Materials	07	18

	Definition & Characteristics of Thermal insulators. Preparation, Properties & Applications of Thermocouple & glass wool, cork, asbestos.		
07	**Lubricants** 7.1 Definition of lubricant, lubrication, 7.2 Functions of lubricants ,need of lubrication 7.3 Classification of lubricants with examples, 7.4 Mechanism of Lubrication by Fluid Film, Boundary& Extreme Pressure, 7.5 Physical Characteristics of Lubricants Such as Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, Cloud & Pour Point. 7.6 Chemical Characteristics such as Acid Value , Neutralization Number, Emulsification, Saponification Value, Selection of proper Lubricants for various types of machines.	06	08

List of practicals (any ten)

1. Orbital configuration of different elements (at least 10 elements)
2. To verify Faraday's first Law of electrolysis.
3. To determine neutralization point of acetic acid (weak acid) and ammonium hydroxide (Weak base). calculate the normality and strength of acetic acid.
4. To determine the equivalent point of precipitation titration of $BaCl_2$ with H_2SO_4 using Conductivity Meter. To find the normality and strength of $BaCl_2$
5. To find the strength in grams per liter of the given solution (NaOH) with the help of standard hydrochloric acid.
6. To determine pH value of given solutions, water samples, by using pH paper, universal indicator and pH meter.
7. To determine the strength of given hydrochloric acid solution by titrating it against standard potassium hydroxide solution.
8. To determine percentage of iron from steel by titration method.
9. To determine the hardness of potable water and boiler feeding water.
10. To determine the chloride content potable water and boiler feeding water.
11. Preparation of phenol formaldehyde plastic.
12. To determine the acid value of oil sample by neutralization method.
13. Qualitative analysis of given salt solutions, i.e. to determine one acidic and one basic radical from given salt solution. (At least 05 salt solutions.)

Text Books:

Sr. No.	Title	Author	Publication
1.	Chemistry of engineering materials	S.S.Narkhede	Nirali publication
2.	Chemistry of engineering materials	Shane patil	Tata tech publication
3	Chemistry of engineering materials	Jawale	Mc vranda publication. Inc.

Reference books :

S.No.	Title	Author	Publication
1.	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons Co.
2.	Engineering Chemistry	R.S. S. S. Dara	S. Chand Publication
3.	Environmental Chemistry & Pollution Control	S. S. Dara	S.Chand Publication

5G105 Workshop Practice (WSP)

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	03	Max. Marks	--	--	50	--	--	50
Total credits	03	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

1. To understand use of different hand tools and workshop processes.
2. To perform basic workshop processes such as smithy, forging, carpentry, welding, plumbing & fitting.

Rationale:

The knowledge of different basic tools and different processes such as smithy, forging, carpentry, welding, plumbing, fitting etc. is the basic requirement of the diploma technician. These are the basic & fundamental operations encountered in workshop. At this level it is essential to impart the practical feel of these basic operations & processes to the students. With this intention this course is being introduced.

Course Contents:

TERM WORK:

1) Smithy & Forging: - One job involving cutting, bending, drawing down/ up operations.
2) Carpentry: - One Job involving different types of carpentry joints (min. two joints) used in furniture, wooden items with the use of teak wood, combination of wood & steel frames, plywood, sun mica.
3) Welding: - One job welded joint involving operations such as Lap, Butt welding with the help of Arc Welding machine.
4) Fitting & Filling: - Fitting and filing one job involving filing, chamfering, drilling, tapping etc. operations.
5) Plumbing: - One practical job on pipe fitting and threading.

Job diary, drawing of different types of tools, operations is to be submitted by each candidate.

Text Books:

Sr. No	Title and Edition	Author	Publisher
1	Workshop technology Vol. 1	B.S. Raghuwanshi	
2	Workshop technology Vol. 1	S.K. Hajra Choudhary	
3	Production technology	R.K. Jain.	

5G106 Engineering Graphics (EGR)

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	50	--	100
Total credits	04	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):
To understand the basic principles of Engineering Drawing

Rationale:
Engineering drawing (Graphics) is the language of engineers. Often it is required to imagine the different objects from various directions, sound knowledge of engineering graphics will help the engineer to represent various objects and read various drawings used in workshop, industry and in various manufacturing processes.

Contents: Theory

Chapter	Name of the Topic	Hours
01	**Introduction** 1.1 Drawing Instruments and their uses 1.2 Letters and numbers (single stroke vertical) for main title, sub-title and normal use 1.3 Different types of lines, Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size), Plain scale and Diagonal scale. 1.5 Sheet sizes and layout, Geometrical constructions 1.6 Dimensioning, its methods, parallel and chain dimensioning, radius and diameter dimensioning, leader and its use, dimension with text	04
02	**Simple Drawing Practices** 2.1 Drawing of different circles with thin, thick, center line use, dividing circle into number of equal parts, dividing line into equal parts 2.2 Drawing pentagon, hexagon and rhombus, drawing correct arrows to dimension lines, drawing tangent to circle from given point	04
03	**Engineering Curves** 3.1 To draw ellipse by – • Arcs of circle method • Concentric circle method • Oblong method 3.2 To draw parabola by – • Directrix focus method • Rectangle method	08

	3.3 To draw hyperbola by – • Transverse axis & focus method. • Passing through a given point (Rectangular hyperbola) 3.4 To draw involute of square, hexagon and circle. 3.5 To draw cycloid, epicycloid, hypocycloid.	
04	**Orthographic Projections** 4.1 Converting pictorial view into orthographic views (First angle method of Projection), 4.2 Sectional orthographic projection of simple objects	08
05	**Isometric Projections** 5.1 Isometric projection of simple objects 5.2 Isometric projection of objects having circular holes	08

LIST OF PRACTICAL/EXPERIMENTS:

A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

1. Home assignment in Sketch book on lines, lettering, numbers and geometrical constructions which includes additional drawings given in chapter 1 & 2 **(No Sheet)**
2. Two sheets on Engineering curves, (Minimum 6 curves).
3. One sheet on Orthographic Projection, (Minimum 2 objects) by first angle method
4. One sheet on Isometric projection of simple object (Minimum 2 objects).

PRACTICAL EXAMINATION:

At the end of term practical examination of 50 marks of 2 Hours duration is compulsory to all students. External and Internal Examiners should set and assess the Question paper jointly as per following guidelines

a) Engineering curves (Solve any one out of two given) 12 marks
b) Geometrical construction & scales (Solve any one out of two given) 08 marks
c) Orthographic Projections (One Problem) 15 marks
d) Isometric projections (One Problem) 15 marks

Text Books:

Sr. No.	Title	Author	Publisher
01	Engineering Drawings	N. D. Bhatt	Charotar Publishing House
02	Engineering Drawings	Sidheshwar, Shastri	Tata Mc Graw Hill
03	Engineering Drawing	R.V.Mali	Vrinda Publication

5G107 Basics of Computer Systems (BCS)

Teaching Scheme		Evaluation Scheme						
TH	01		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	50	--	100
Total credits	03	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- To understand working & use of Computer for day-to-day use.
- To use computer for word processing, accounting related applications
- To prepare professional presentations.
- To understand and use Internet.

Rationale:

With rapid development of Technology and competitive economy, computers play very important role in the diversified fields such as computer aided design of circuits, power generation, image processing, telecommunication modeling and simulation etc. The built in characteristics of computers have made them inevitable in different applications areas. So it is essential for a Diploma Technician to have a knowledge regarding computers and develop a skill to handle different software's available. It is always essential for a technician to update their knowledge to cope up with the fast development in software. Considering this in view and duties to be performed by Diploma Technician in professional life, following curriculum is suggested.

Course objectives:

Student should be able to,

- Understand working of computers
- Get knowledge of various components of computers.
- Understand concept & functions of Operating System.
- Perform file management operations using My computer & Windows Explorer
- Print the letter using MS Word
- Perform worksheet operations using MS Excel
- To prepare professional presentations using MS PowerPoint
- Use Internet for Create E-mail id, receive & send E-mail with attachment
- Search for the information on Internet.

Contents: Theory

Chapter	Name of the Topic	Hours
01	**Fundamentals** 1.1 Types of computer, Block Diagram showing components of computer 1.2 Input & output devices, CPU 1.3 Primary Memory, Secondary memory (usage of memory) 1.4 Processor and its speed, RAM, Monitor, Display card 1.5 Hard Disk, Floppy drives, CD drive, Sound card, etc.	02

	(use of each) 1.6 Hardware and software 1.7 Types of software, concept of Operating System definition, functions and examples of operating system (like DOS, WINDOWS, Linux).	
02	**Windows** 2.1 Bios, Power on self-test.. 2.2 Concept of file & directory, rules for file & directory names. 2.3 WINDOW 98/2000/XP 2.4 Introduction Starting Windows, Desktop, Icons, Task bar, Short cuts, The start Button, Arranging windows, Shutting down windows . 2.5 Windows Explorer: Creating, renaming, deleting Folders/ file. Copying, moving, deleting, renaming files, Using Send to, Search files and folders, Recycle bin 2.6 Windows Setting: Date format, adding printer. 2.7 Windows Accessories: Calculator, Notepad, paint, word pad.	03
03	**Ms-Word** 3.1 Introduction to word processing, Introduction to MS word. Opening, Saving, closing a file. 3.2 Page setup: Changing Margins, layout, and paper size. Formatting Text: 3.3 Tables: Insert table, enter and edit data into table. 3.4 Printing: Print preview, selecting printer, and print options	03
04	**Ms-Excel** 4.1 Introduction to electronic spreadsheet. Introduction to MS Excel. 4.2 Components of MS Excel window like Title bar, Menu bar, Formula Bar, Status bar, 4.3 Worksheet area, Sheet Tabs, Columns, rows. Hiding and viewing Toolbars like standard and formatting tool bars. Entering data, copying, moving, Editing cell entries use of auto fill Saving, closing and opening file. 4.4 Page setup: Changing Margins, layout, and paper size. Enter formula, copy formula using fill handle Inserting functions. 4.5 Use of functions like SUM, AVERAGE, MIN, IF, COUNT, LOG, SIN, COS, ROUND, SQRT, PI etc. 4.6 Formatting data: Change number format, alignment, borders, font, size etc. Use auto Format,	04

	4.7 Restructuring worksheet: Inserting and deleting the columns and rows. Changing column width, row height. 4.8 Charts (Graphs): Types of charts, creating and modifying charts, printing charts.	
05	**PowerPoint** 5.1 Overview, Using design template and auto content Wizard 5.2 Creating presentation, slides and its types, slide operations, modifying & running presentation, adding & editing objects, creating tables, charts & Diagram, save & print option ,custom presentation, applying transition & animation effects.	02
06	**Internet** 6.1 Introduction: Uses of internet, 6.2 Resources required using Internet. Internet Service Provider: Need & Duties of ISP, 6.3 Connecting to Internet, Domain &addresses, Internet Browsers, Search engines , Email, Chat.	02

List Of Practicals

(If required specify minimum number of practicals to be conducted from the following)

1. List and identify the peripheral devices of a PC. Connect the keyboard, mouse, printer, monitor, and scanner to a computer. Get the information about the manufacturers and prices of various components of a PC.

2. Windows

Start and shutdown of windows. Starting different applications. Using applications like calculator, paint, word.

Observe various features of windows like menus, push buttons, drop down list, check boxes, option buttons etc.

Perform file management operations such copying, deleting, renaming, creating folders, renaming folders using My computer , Windows Explorer, searching files and folders.

Change windows format such as wall paper, date & time format, Installing printer, installing & removing programs by using add /remove programs, change display properties.

3. Microsoft Word

- Prepare a sample bio data
- Write an application for job
- Prepare a time table in tabular format

4. Microsoft Excel

Create a sample result sheet of your class.

Create salary sheet for Employees (Apply Excel formulae/ functions to solve problems.)

5. Internet

- Creation of email account
- Send E-mail, Receive E-Mail. (use attachment)
- Management of email account.
- Searching information on internet

6. PowerPoint

- Creating PowerPoint presentation, Running presentation.
- Applying design template, background, transition effects, animation slide.
- Preparing custom presentations and using pack and go features.

Reference books :

Sr. No	Title of Book	Author and Publication
1	Fundamentals of Computers	P.K.Sihna BPB Publication
2	Teach Yourself Windows 98	Greg Perry Techmedia
3	Teach Yourself Windows 98	Cassel & Hart Techmedia
4	Windows 98 Bible	Alen Simpson BPB Publication
5	MS Office 2000	Ed Bott Woody Ceonhard (PHI)
6	Microsoft Office	Ron Mansfield BPB Publication
7	Teach Yourself MS Office 97	Greg Perry Techmedia

5E201 Electrical Engineering (EEG)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
TOTAL	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Draw , Read and interpret circuits related to Electrical Engineering.
- Selection of Electrical Engineering materials.
- Operate and design simple electrical control circuits.
- Adopt electrical safety practices.
- Select, connect and operate electrical measuring instruments.
- Numerical ability to solve problems.
- Awareness of social responsibilities and work in a groups.
- Update the knowledge and skill to suit to new technology as life long learner.
- Attitude towards initiative, hardworking & punctuality.

Rationale:

This is the course which every Electrical Engineering student must study before going for higher course in Electrical Engineering and analyzing of electrical circuits which are commonly used in measurement , instrumentation, electronics, electric machines, electrical power system.

Course objectives:

- Student will be acquainted with the facts of electrical circuits, magnetic circuits, circuit elements, tools, equipments, type of circuits, sources etc.
- Student will know the basic concept of circuits, properties of electromagnetic and electro static fields, a. c. quantities.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Fundamentals** 1.1 Structure of atom, current, emf, voltage or potential, voltage drop/potential difference. 1.2 Resistance, Laws of resistances & concept of resistivity 1.3 Conductors, semi conductors and insulators 1.4 Effect of temperature on resistance 1.5 Resistance temperature coefficient. 1.6 Ohm's law 1.7 Series & parallel combination of resistances (simple numericals) 1.8 Division of currents in parallel branches (simple numericals) 1.9 Kirchhoff's current and voltage law (KCL,KVL) (simple numericals)	24	28

	1.10 Specifications of commonly used electrical appliances. 1.11 Calculation of electricity bill (simple numericals) 1.12 Capacitance, permittivity, capacitors in series and Parallel (simple numericals) 1.13 Charging and discharging of capacitor.		
02	**Magnetism and Series Magnetic Circuits** 2.1 Concept of magnetic lines of forces, magnetic field. 2.2 Flux, Flux density, MMF, Reluctance. 2.3 Absolute and relative permeability 2.4 Magnetic hysteresis, hysteresis loop, hysteresis loss. 2.5 Eddy currents & Eddy current loss. 2.6 Method to minimize hysteresis & Eddy current loss. 2.7 Series magnetic circuit (simple numerical) 2.8 Electric and magnetic circuit similarities & Dissimilarities 2.9 Force on current carrying conductor placed in a magnetic field, Fleming's Left Hand Rule	20	24
03	**Electromagnetism and Electromagnetic Induction** 3.1 Electromagnet & its advantages over permanent magnet , its use. 3.2 Faraday's laws of electromagnetic induction 3.3 Lenz's law 3.4 Fleming's right hand rule & its application. 3.5 Statically and dynamically induced emf	08	10
04	**A.C. Fundamentals** 4.1 Generation of alternating emf , equation of a.c. quantities 4.2 Definition of cycle, frequency, time period, Instantaneous value, amplitude, phase & phase difference, root mean square (rms) and average values, form factor, peak factor 4.3 Various forms of emf equation of a.c. 4.4 Simple numericals on above topics	08	12
05	**House Hold Electric Circuits** 5.1 Electrical layout of domestic supply system 5.2 Types of switches and lamps 5.3 Working of fluorescent tube, sodium & mercury vapor lamp. 5.4 Necessity of fuse, types, commonly used ratings.	04	06

Practicals (All compulsory)

1. A) To know the laboratory & draw its layout, list the major equipments with their ratings.
   B) To understand the safety precaution to be observed while working in laboratory.
   C) To draw the single line diagram of electrical supply system in laboratory.
2. A) To understand the importance & use the fire extinguisher.
   B) To understand the methods of artificial respiration.
3. Use a rheostat as a current regulator
4. Use a rheostat as a potential divider
5. To measure a.c. and d.c. voltages in the laboratory.
6. To construct a simple circuit using rheostat, ammeter, voltmeter & wattmeter and to measure different electrical quantities and verify ohms law.
7. To plot B-H curve of a field winding of a d.c. machine
8. To verify Kirchhoff's current law.
9. To verify Kirchhoff's voltage law.
10. To study connections of a distribution/extension board.
11. To study the connections & working of a fluorescent tube using choke & starter.

Reference Books:

Sr. No.	Author	Title	Publication
1	B.L. Thereja	Electrical Technology –Vol.-1	S.Chand
2	V.K. MEHTA	Fundamentals of Electrical Engineering	S. Chand
3	J.B. Gupta	Electrical Technology –Vol.-1	S.K. Kataria & sons

5E202 Fundamentals of Electronics (FOE)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
TOTAL	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge of various Electronics components
- Knowledge of electronic measuring devices

Rationale:

From this course the students understand construction, operation, characteristic and applications of electronic devices.

Course objectives:

Student should be able to,

- Design of a.c. to d.c. converter.
- Design of amplifier circuits.
- Design of D.C power supply.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Semiconductor Diode** 1.1 Intrinsic semiconductor 1.2 Extrinsic semiconductor 1.3 P- type semiconductor 1.4 N- type semiconductor 1.5 Concept of P-N junction 1.6 Formation of depletion layer 1.7 Forward bias and reverse biasing 1.8 Characteristics of semiconductor diode	06	08
02	**Rectifiers and Filters** 2.1 Half wave rectifier 2.2. Full wave rectifier 2.3 Bridge rectifiers 2.4 Ripple factor 2.5 Transformer utilization factor and rectification efficiency 2.6 Capacitor filter. 2.7 Choke input filter 2.8 Capacitor input filter or Π filter 2.9 Numericals on rectifier	13	16
03	**Special Diode** 3.1 Types and characteristics of special diodes, signal diodes	06	08

	3.2 Power diode 3.3 Zener diode 3.4 Varactor diode 3.5 Light-emitting diode (LEDs) 3.6 Applications of zener diode as a stabilizers and voltage regulator		
04	**Transistor** 4.1 Construction and working of NPN and PNP transistor 4.2 Characteristics and relations of currents of transistors in Common-Base configuration 4.3 Common – emitter and common – collector configuration	11	14
05	**Transistor Biasing** 5.1 Types of transistor biasing 5.2 Base bias 5.3 Base bias with emitter feedback 5.4 Base bias with collector feedback 5.5 Voltage divider bias 5.6 Emitter bias	07	09
06	**Amplifier** 6.1 Use of transistor as an amplifier in common – emitter mode 6.2 Different methods of cascading of amplifiers 6.3 RC coupled amplifier and its frequency response 6.4 Transformer-coupled amplifier 6.5 Direct-coupled amplifier	08	10
07	**Oscillators** 7.1 Sinusoidal Oscillator 7.2 Oscillatory circuits 7.3 Tank circuit 7.4 Barkhausen criterion 7.5 Tuned collector 7.6 Colpitts oscillator 7.7 Hartley oscillators 7.8 LC type oscillators 7.9 Phase shift oscillators	10	10
08	**Regulated Power Supply** 8.1 Three terminal voltage regulators 8.2 78xx series 8.3 79xx series	03	05

List of Experiments (any eight)

1. To plot characteristic of diode and find out the forward resistance of diode.
2. To plot characteristic of zener diode
3. Study of CRO and its function, to measure Frequency and Voltage of unknown wave form
4. Study of half and full wave rectifiers and to observe waveforms on CRO.
5. To plot Regulation characteristic of Filters
6. To plot the I/P & O/P characteristics of transistor CB configuration
7. To plot the I/P & O/P characteristics of transistor CE configuration
8. To plot the I/P & O/P characteristics of transistor CC configuration
9. Study of Transistor as an Amplifier
10. To study RC coupled amplifier & its frequency response
11. Study of Colpitts/Hartley Oscillators and determine frequencies of oscillation
12. To test regulated power supply of IC 78 series /IC 79series for different O/P voltage

Reference Books:

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Sr No.	Author	Title	Publisher
1	V.K.Mehta	Principal of Electronics	S.Chand
2	B.L Theraja	Basic Electronics	S.Chand
3	R.S. Sedha	Applied Electronics	S.Chand
5	N.N. Bhargava	Basic Electronics and Linear Circuits	Tata McGraw-Hill

5E203 Electrical Measurement (ELM)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	50	--	175
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Select proper electrical measuring instruments for proper application.
- Measure different electrical quantities**.**
- Calibrate different electrical meters.
- Identify the errors & take measures to compensate.
- Extend the range of meters by suitable provision.

Rationale:

Measurement of various electrical quantities are absolutely required in many fields and hence study of different methods of measurements and instruments is expected to be covered in curriculum

Course objectives

- State the working principles and explain the constructional details of various electrical measuring instruments
- Identify and test various instruments.
- State the utility of various instruments in practice

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Introduction** 1.1 Classification of Instruments based on (a) Electrical effects used. (b) Nature of Operation (c) permissible limit of errors (Standard, substandard) 1.2 Indicating, integrating and recording type 1.3 Qualities of Instruments like - sensitivity, precision, accuracy, and reliability 1.4 A brief introduction to deflecting, controlling and damping torque	06	08
02	**Ammeters and Voltmeters** 2.1 Introduction - Ammeters and voltmeters 2.2 Construction , principle of operation, Merits & demerits of (i) P.M.M.C. (ii)Moving iron (iii)Dynamometer type instruments	08	12

	2.3 Torques produced in (i) P.M.M.C.(ii)Moving iron (iii)Dynamometer type instruments 2.4 Extension of range of ammeter using shunt & voltmeter using multiplier (simple numericals) 2.5 C.T. & P.T. Construction, Requirement 2.6 Clamp on meter- Construction and working		
03	**Measurement of Electrical Energy** 3.1 Construction and principle of operation of Single phase and Three phase Induction type energy meter 3.2 Different errors and their correction 3.3 Calibration of single-phase energy meter & Three phase energy meter 3.4 Introduction to Digital Energy Meter	08	10
04	**Measurement of Power** 4.1 Concept of power (Active, Reactive and apparent power) 4.2 Principle of operation and construction of dynamometer type Wattmeter 4.2 Different errors and their compensation 4.3 Construction and operation of Poly phase wattmeter. 4.4 Multiplying factor of wattmeter 4.5 Power measurement in three-phase circuit for balanced load conditions with one ,two wattmeter method (simple numericals) 4.6 Measurement of reactive power in a 3 phase balanced load with one wattmeter method	12	18
05	**Measurement of Resistance** 5.1 Classification of Resistances- Low, medium, high 5.2 Measurement of resistance by Ammeter, Voltmeter method and its limitations 5.3 Resistance measurement by wheat stones bridge, Kelvin's double bridge. 5.4 Construction and working principle and measurement of resistance with Megger & Ohmmeter 5.5 Construction and principle of working of Earth tester and measurement of earth resistance	10	12
06	**Potentiometer** 6.1 Principle of operation of D.C. potentiometer. 6.2 Standardization of Potentiometer and unknown e. m .f. measurement by Potentiometer, Low resistance measurement by potentiometer 6.3 Calibration of ammeter and voltmeter by Potentiometer	08	08
07	**Other Instruments** 7.1 Construction, Principle of operation and use Of Single and three-phase Electro-dynamometer type power factor meter 7.2 Construction, Principle of operation and use of electrical	12	12

	resonance type and Weston type frequency meter 7.3 Use of Synchroscope 7.4 Construction, Principle of operation and use of phase sequence Indicator-Static type & Rotating type		

List of Practicals: (Any ten)

1. Study of construction of wattmeter and its multiplying factor
2. Measurement of power in 3 phase balanced circuit by one-wattmeter method
3. Measurement of power in 3 phase balanced circuit by two-wattmeter method
4. Measurement of Reactive power in 3 phase balance circuit by one wattmeter
5. Measurement of low resistance by Kelvin's Double Bridge.
6. Calibration of D.C. Ammeter and D.C. voltmeter by Potentiometer
7. Study of Megger & measurement of insulation resistance by Megger
8. Measurement of medium resistance by Wheat stone bridge
9. Measurement of low resistance by Kelvin's bridge
10. Calibration of Single phase energy meter by comparison
11. Measurement of Earth resistance by Earth Tester

Reference books :

Sr No.	Author	Title	Publication
01	A.K Sawhney	A course in. Electrical Engineering Measurement and Instrumentation	Dhanpat Rai & Co.Pvt.Ltd. Delhi
02	E.W Golding. & F.C Widdis	Electrical Measurements and Measuring instruments	Wheeler Publishing, Allahabad
03	N.V Suryanarayana	Electrical Measurements and Measuring instruments	Tata McGraw-Hill Publishing Co.Ltd.

5E204 Network Analysis (NWA)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	50	--	175
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- To calculate various electrical circuit parameters

Rationale:

The course is useful for designing any electrical circuit.

Course objectives:

Students should be able

- To calculate the voltage and current in the system
- To understand the different methods of circuit analysis
- To study various important electrical theorems & their applications.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Basic Circuit Elements** 1.1 Definitions - Network parameters, lumped and Distributed parameters, node, branch, mesh. Active & Passive network, Linear & Non linear network, Bilateral and unilateral network. 1.2 Ideal and practical voltage and current sources. 1.3 Source transformation. 1.4 Delta- star and Star-delta transformation (simple numericals)	08	10
02	**D.C Network Theorems** 2.1 Maxwell's loop current method 2.2 Nodal analysis 2.3 Superposition theorem 2.4 Thevenin's theorem 2.5 Norton's theorem 2.6 Maximum power transfer theorem 2.7 Numericals based on above	20	24
03	**A.C. circuits and Resonance** 3.1 A.C. through pure resistance, inductance & Capacitance, their current, voltage and power relations, vector diagrams, waveforms, power factor 3.2 "j" operator 3.3 Rectangular & polar form of vectors	20	24

	3.4 Addition, subtraction, division and multiplication of Vectors 3.5 A.C. through R-L, R-C & R-L-C series circuits (simple numericals) 3.6 Parallel a.c. circuits (simple numericals) 3.7 Series & Parallel resonance , Q factor 3.8 Graphical representation of series & parallel resonance		
04	**A.C.Network Theorems** 4.1 Mesh analysis 4.2 Nodal analysis 4.3 Superposition Theorem 4.4 Thevenin's Theorem 4.5 Simple numericals on above theorems	12	16
05	**Magnetic Coupled Circuit** 5.1 Self inductance 5.2 Mutual inductance 5.3 Coefficient of coupling 5.4 Dot convention 5.5 Series connection of coupled coils	04	06

List of Experiments

1. To verify superposition theorem
2. To verify Thevenin theorem
3. To Verify maximum power transfer theorem
4. To calculate p.f. of a R-L series circuit, and draw phasor diagrams
5. To calculate p.f. of a R-L-C series circuit, and draw phasor diagrams.
6. To obtain series resonance by varying L and/or C
7. To calculate p.f. of a R-L-C parallel circuit, and draw phasor diagrams.
8. To measure net inductance of series inductors

Reference Books:

Sr. No	Author	Title	Publisher
1	A. Chakrabarti	Circuit theory	Dhanpat Rai & Co.
2	D.Roy chaudhury	Network & system	Wiley Eastern Ltd.
3	B.L Thereja	Electrical Technology Vol-I	S. Chand & Co. Ltd
4	A. sudhakar	Circuits & Networks	Tata McGraw Hill co. Ltd
5	Ashfaq Husain	Networks and systems	Khanna book publishing

5E205 Generation and Transmission Engineering (GTE)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- To understand basic concept of Generation and transmission of Electrical Energy.
- To draw, read and interpret circuit diagrams, block diagrams and layouts related with power stations.
- Compare power stations with respect to given points.
- Draw load curve & load duration curve.

Rationale:

With rapid development of technology and competitive economy, Electrical energy plays a very important role. The electrical power before being utilized by the consumer has to pass through various stages like transmission, distribution stations, substations etc. It is always essential for a technician to know the generation and transmission process of electrical energy as well as stages of power transmission. Considering this in view following curriculum is suggested for Diploma Engineers.

Course objectives:

Student should be able to**,**

- Understand working of power stations in brief.
- Get knowledge of various components of Transmission lines
- Understand line and block diagram of various conventional power stations
- Know the mechanical and electrical details of transmission systems.
- Work in power Supply Company.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Sources of Energy** 1.1 Conventional and non-conventional sources of Energy. 1.2 Electrical power stations in Maharashtra with type and installed capacity. 1.3 Standards for frequency and voltages for generation and transmission	04	04
02	**Thermal Power Station (TPS)** 2.1 Block diagram of T.P.S, Energy conversion process at each stage. 2.2 Selection of site for TPS 2.3 Main components - coal and ash handling plant, boiler, economizer, air pre heater, super heater, ID & FD fans, condenser, cooling towers, turbines, precipitator. 2.4 Advantages and disadvantages of TPS	08	10

03	**Hydroelectric Power Station (HPS)** 3.1 Block diagram of H.P.S, Energy conversion process at each stage 3.2 Selection of site for H.P.S. 3.3 Main components-Reservoir, dam, fore-bay, surge-tank, penstock, spill-way, tail-race, catchment area. 3.4 Classification of head, pumped storage plant. 3.5 Advantages and disadvantages and comparison with T.P.S.	08	08
04	**Nuclear Power Station (N.P.S)** 4.1 Block diagram of N.P.S, Energy conversion process at each stage. 4.2 Components --- Reactor, heat exchanger and Condenser. 4.3 Disposal of nuclear waste 4.4 Advantages and disadvantages. 4.5 Comparison with T.P.S. & H.P.S	06	09
05	**Performance of Power Station** 5.1 Load curve and load duration curve. 5.2 Definitions of connected load, maximum demand, average load, installed capacity, rated capacity, load factor, diversity factor, plant use factor. 5.3 Choice, rating and number of units for a given load curve and operation schedule (simple numericals). 5.4 Concept of economical load division between power station for a given load duration curve (only theory). 5.5 Base load and peak load stations**.**	06	10
06	**Transmission Systems** 6.1 Layout of transmission system. 6.2 Overhead and underground transmission system. 6.3 Single phase and three phase transmission system. 6.4 HVAC and HVDC transmission system 6.5 Advantages and disadvantages & comparison between Above systems.	08	08
07	**Constructional Features of Transmission Line** 7.1 Types of supports and clearance from ground 7.2 Types of Insulators, causes of failure of insulators. 7.3 Potential distribution over a string of disc insulators, string efficiency (simple numericals on string efficiency up to three units). 7.4 Conductors--Aluminum, copper, ACSR, bundled conductors	10	12
08	**Performance of Transmission Lines** 8.1 Transmission line parameters - resistance, inductance and capacitance. (No derivations or numericals) 8.2 Skin effect, Proximity effect and Ferranti effect.	12	15

	8.3 Concept of short, medium and long transmission lines. 8.4 Equivalent circuits of short and medium transmission lines. 8.5 Nominal T and Pie methods. (Pharos diagrams only) 8.6 Efficiency and regulation of Short and medium transmission lines. 8.7 Effect of load p.f. on regulation and efficiency of short transmission lines.		
09	**Corona** 9.1 Concept of corona and Definition. 9.2 Formation of corona 9.3 Advantages and disadvantages of corona. 9.4 Methods for reducing the effects of corona.	02	04

Practicals

Visit report on visit to Hydroelectric and thermal power station.

Two Drawing Sheets on constructional details of transmission lines. (Supports and insulators) & One Lay out of generating station.

Reference books:

Sr. No.	Author	Title	Publication
1	V.K. Mehta	Principles of power system	S.Chand
2	Soni, Gupta, Bhatnagar	Electrical power system	Dhanpatrai & sons
3	B.R. Gupta	Generation Engineering	S.Chand
4	S.L.Uppal	A Text book of Electrical power	Khanna Publications
5	J.B. Gupta	Power systems	S.K. Kataria sons

5E206 Electrical Workshop Practice (EWP)

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	50	100
Total credits	02	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- Selection of Electrical Engg materials
- Adopt Electrical safety practices
- Follow IE rules and IS codes in Electrical engineering practice

Rationale:

A technician should also have the practical skills regarding wiring, in order to provide him/her the various ways, techniques of fault finding while working on the shop floor. These skills will be developed when he/she actually performs the work.

Contents: Hands on practice

1. To prepare an extension board
2. To dismantle, repair, assemble & test the following electrical accessories (Any five)

   a) Automatic electrical iron
   b) Water heater
   c) Geyser
   d) Ceiling fan
   e) Drill machine
   f) Refrigerator
   g) Voltage stabilizer
   h) Fluorescent tube
3. Identification of components, fault finding & repairs in power panel wiring.
4. Study of Electrical connections of…. (any two)
   a) Water pump (single phase)
   b) D.O.L. Starter
   c) ICTP
   d) ICDP
   e) Circuit breakers
   f) MCB
   g) ELCB
   h) Relay
5. To observe the effect of fuse under normal and abnormal conditions
6. Light up two lamps controlled by two independent SPT switch.

5E207 Development of Life Skill (DLS)

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	50	100
Total credits	02	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):
Student should be able to ……

- Communicate with staff &friends confidently.
- Share their problems with staff by effective communication.
- Do SWOT analysis.
- Work in groups without stress.
- Manage the time.
- Implement ethics in day today life.
- Adopt effective interview techniques.

Rationale: This subject is basically a human science subject. It is intended to develop the abilities of the students to work effectively in a team .The purpose of this subject is make students confident and competent in managing and executing engineering projects. Student centered case studies and project methods should be used to develop practical skills while teaching this subject. It is also expected that the content and associated skill development should be re-enforced through other courses at suitable levels.

The students shall be aware of following and shall learn techniques to develop the qualities to face various day to day life problems.
This is to be achieved by collecting data on following topics from books, news papers (print media) or through audio visuals or internet and presentation in front of group.
The faculty should discuss the below mentioned topics with students and student should submit the same as an assignment.

1. Communication Techniques
   Co-operation, collaboration, How to work in teams, Oral communication, Body language, Persuasive skills, Listening skills
2. Self Development
   SWOT analysis
3. Stress (identification and remedies)
   Stress in group work, Strategies to overcome stress, understanding importance of good health & various ways to avoid stress.
4. Motivation
   Necessity of motivation, Methods of motivation, Methods to measure degree of success achieved through motivation.

5. Health
   Necessity of good health for success, Physical health, mental health , methods to achieve good health.

6. Time management
   Importance of time management, How to minimize time loss, Deciding priority of jobs, Time matrix.
7. Ethics
   Definition of ethics, importance, How ethics help in increasing quality of inter-personal relationships, Personal quality primer, Methods of achieving good ethics.
8. Interview Techniques
   How to approach interview , Methods of successful interviews, Importance of body language and confidence in Interviews, Positive attitude in interviews.

5G301 English (ENG)

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	--	125
Total credits	04	Duration (Hrs.)	1	3	--	--	--	--

Competency statement(s):

• To develop Theoretical concepts and practical implementations of English language
• To develop writing skills.

Rationale:

English is the only language used all over the world. It is necessary to gain command over English language .English is also developed as a language of International, Trade& Commerce, Library, Link language. This subject helps the students to:

- Become competent in English Grammar and its usage.
- Write and speak English confidently correctly.
- Gain command over English language.
- Learn the modern methods of English such as sending, receiving emails to be competent with International trends.
- To use proper pronunciations

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Text from Book** 1.1 Comprehension – Responding to the questions from text (Spectrum) 1.2 Vocabulary - Understanding meaning of new words from text 1.3 Identifying parts of speech from the text.	16	30
02	**Situational Grammar** 2.1 Tenses and Time 2.2 Yes/No, Wh-questions and Question Tags, Punctuation Marks 2.3 Reported Speech; Voice ;Degree 2.4 Articles ,Prepositions, Conjunction	10	25
03	**Craft of Writing** 3.1 Paragraph Writing-Definition, Types, Essentials. 3.2 E-mail 3.3 Resume	04	15
04	**Functional English** 4.1 Vocabulary building- (Synonyms Antonyms, Homophones) sounds and syllable Sentence structures 4.2 Use of Contextual words in a given paragraph.	02	10

List of Assignments:

1) Building of Vocabulary
Words from the glossary given at the end of each chapter, to be used to make sentences.

2) Applied Grammar
Identify the various parts of speech and insert correct parts of speech in the sentences given by the teacher.

3) Punctuation
Punctuate 20 sentences given by the teachers.

4) Tenses
List 12 tenses and give two examples for each tense.

5) Dialogue Writing
Write at least two dialogues on different situations.
(Conversation between two friends, conversation between two politicians etc.)

6) Idioms and Phrases
Use of Idioms and Phrases in sentences. (20Examples)

7) Biography
Write a short biography on your favorite role model approximately 250 to 300 Words with pictures

TEXT BOOKS

Sr. No.	Title	Author	Publication
1	Spectrum- A Text Book on English	--	MSBTE

Reference books :

Sr. No.	Title	Author	Publication
1	English grammar and Composition	R.C.JAIN	Macmillan
2	Dictionary	Oxford	Oxford University
3	English at Workplace	Mukti Sanyal	Macmillan
4	A Remedial English Grammar for Foreign Students	P.T.WOOD	Macmillan

5G302 Communication Skills (CMS)

Teaching Scheme		Evaluation Scheme						
TH	01		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	25	75
TOTAL	03	Duration	--	--	--	--	--	--

Competency statement(s):
The student should be able to:

1. To develop Listening, Speaking, Reading and Writing skills.
2. Ability to engage & interact effectively with others.
3. To enable an individual to express perfectly.
4. To use appropriate body language.
5. To obtain acceptance & provide assistance, direction & leadership.

Rationale:
Language skills pertaining to English have been already introduced previously. With a view to achieve some command over a language & to develop communication skills is the main objective of this subject.

Contents: Theory

Chapter	Name of the Topic	Hours
01	**Introduction to Communication** 1.1 Definition, Importance Communication cycle/process 1.2 The Elements of communication	04
02	**Types of Communication** 2.1 Verbal-Nonverbal, Formal – Informal, Upward-Downward, Vertical-Horizontal-Diagonal Communication.	02
03	**Principles of Effective Communication :** 3.1 Principles of effective communication 3.2Communication Barriers & how to overcome them	04
04	**Non Verbal Communication** 4.1 Aspects of body language(gestures, postures etc.) 4.2 Pictorial Representation(tables, graphs, pie chart etc.)	02
05	**Formal Written Skills** 5.1 Office Drafting: Circular, notice & memo 5.2 Job Applications 5.3 Business Correspondence: Inquiry , order letter & adjustment letter	04

List of Practicals-

01 Communication Cycle (With the Help of Diagram) + any two communications Situations to be represented with the help of Communication Cycle. (Use Pictures)
02 Speech
03 conversation
04 Group discussion
05 Non-Verbal Communication:
Body Language: Five Illustrations of appropriate use of Body Language used on the part of student in formal and Informal setups.
(Example- formal setup- classroom)

06 Seminar related on any topic.
07 Interview Techniques
08 Job Application & Effective Resume Writing

Reference books :

S.No.	Title	Author	Publication
1.	Text book of Communication skills	MSBTE	MSBTE
2.	Everyones guide to Effective Writing	Jayakaran	Apple
3	Developing Communication Skills	Krushnan Mohan,Meera Banarji	Macmillan
4	Professional Communication Skills	Pravi S R Bhatia	S. chand & co.

5G303 Entrepreneurship Development (END)

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	25	--	25	50
TOTAL	04	Duration (Hrs.)	--	--	--	--	--	--

Rationale:

The post liberalization industrial and economic scenario in India makes it imperative that a more dynamic and pragmatic approach be adopted to create new, first generation entrepreneurs on a large scale.

This would help in tackling the problem of unemployment and contribute to the creation of new entrepreneurs. Using knowledge & advanced technology as their strategic tools those who can take on the increased competition in the domestic as well as global markets are innovators and entrepreneurs in true sense. This can be achieved only if more and more people are motivated and convinced to choose entrepreneurship as a career and put their energies and resources to a productive use.

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 subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

Objectives:

Students should be able to

1) Appreciate the importance of entrepreneurship.
2) Identify entrepreneurship opportunity.
3) Get primary information to start any business.
4) Acquire entrepreneurial values and attitude.
5) Use the information to prepare project report for business venture.
6) Develop awareness about enterprise management.

Course Contents:

Chapter	Name of the Topic	Hours
01	**Basic Concepts** 1.1. Concept, Classification & Characteristics of Entrepreneur. Creativity and Risk taking, Concept of Creativity & Qualities of creative person. Risk Situation, Types of risk & risk takers. 1.2 Business Methods and techniques to generate business idea 1.3 Transforming Ideas in to opportunities, transformation involves Assessment of idea & Feasibility of opportunity, SWOT Analysis.	05
02	**Information and Support Systems** 2.1 Information Needed and Their Sources. Information related to project, Information related to support system, Information related to procedures and formalities. 2.2 Support Systems: • Small Scale Business Planning, Requirements. • Govt. & Institutional Agencies, Formalities • Statutory Requirements and Agencies. • Government Support and subsidies to entrepreneur.	05
03	**Market Assessment** 3.1 Marketing -Concept and Importance 3.2 Market Identification, Survey Key components (Market Segmentation) 3.3 Market Assessment	05
04	**Business Finance and Accounts** **4.1 Business Finance** • Cost of Project • Sources of Finance • Assessment of working capital • Product costing • Profitability • Break Even Analysis • Financial Ratios and Significance 4.2 **Business Account** Accounting Principles, Methodology • Book Keeping • Financial Statements • Concept of Audit, • Trial Balance • Balance Sheet	06

05	**Business Plan and Project Report** 5.1 Business plan steps involved from concept to Commissioning, Activity Recourses, Time, Cost 5.2 **Project Report** 1) Meaning and Importance 2) Components of project report/profile (Give list) 5.3 **Project Appraisal** 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis	06
06	**Enterprise Management And Modern Trends** 6.1 Enterprise Management: - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance, Importance of Quality, Importance of testing 5) Industrial zones and SEZ. 6.2 E-Commerce , Concept and process 6.3 Global Entrepreneur: role and opportunities.	05

Practical:

The practical task may be divided in following heads

1. Literature survey – MSFC/IDBI/MSSIDC/CIDBI/MSME/DIC/ ROLE OF DIFFERENT COMMERCIAL BANKS etc.
2. Administration of ready made tools like questionnaires, opinionnaire, Interview schedule for product identification purpose (decision making process).
3. Development of “Business Ideas”.
4. Visit to MCED/MITCON- going through the product related library.
5. Preparation of Preliminary / Detailed project report in the formats recommended by MCED/MITCON.
6. At least one case study of successful entrepreneur..

Text Books

Sr. No	Title of Book	Author and Publication
1	Entrepreneurship Development	TTTI, Bhopal.
2	The Seven Business Crisis& How to Beat them	V.G.Patel
3	A handbook of New Entrepreneurs	P.C.Jain ,Dhanpat Rai and Sons
4	Entrepreneurship development	E.Gorden, K. Natrajan.

5	New Initiatives in Enterprenuership Education And training	Gautam Jain, Debmuni Gupta
6	www.ediindia.org.	
7	Entrepreneurship Theory and Practice	J.S.Saini,B.S.Rathore
8	Enterpreneurship Development and management	A.K.Singh, Laxmi Publications
9	The Beermat Enterpreneur	Southon, Pearson Education limited

Text Books

Sr. No	Title of Book	Author and Publication
1	Entrepreneurship Development	TTTI, Bhopal.
2	The Seven Business Crisis& How to Beat them	V.G.Patel
3	A handbook of New Entrepreneurs	P.C.Jain ,Dhanpat Rai and Sons
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5	New Initiatives in Enterprenuership Education And training	Gautam Jain, Debmuni Gupta
6	www.ediindia.org.	
7	Entrepreneurship Theory and Practice	J.S.Saini,B.S.Rathore
8	Enterpreneurship Development and management	A.K.Singh, Laxmi Publications
9	The Beermat Enterpreneur	Southon, Pearson Education limited

5G305 Industrial Management (INM)

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	05	Duration (Hrs.)	01	03	--	--	--	--

Rationale:

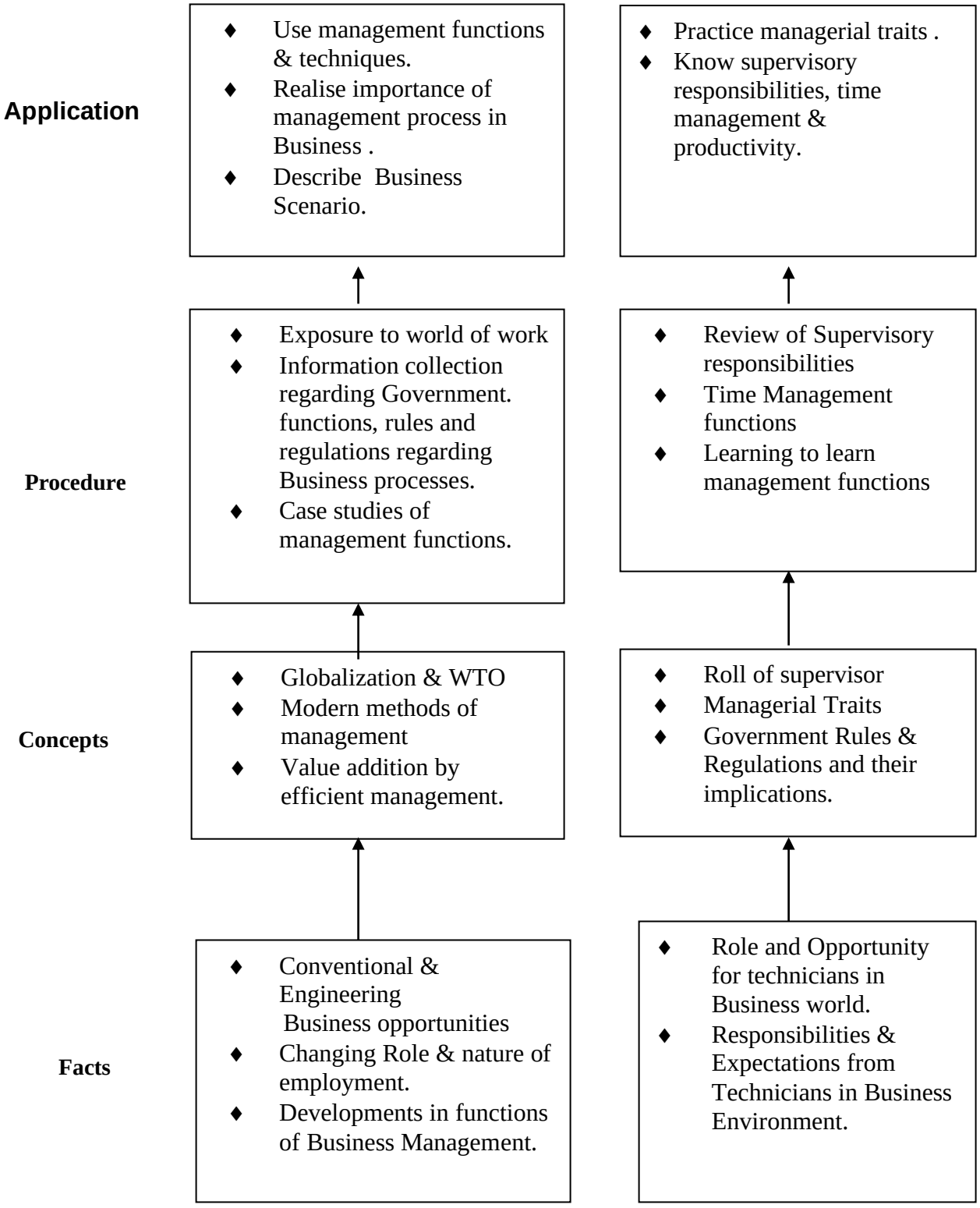
The diploma pass out is middle management cadre in the industrial organizational set up. A proper insight and understanding of Business Processes is therefore essential for All Polytechnic students. Management is a subject which deals with basics of Managerial science required to understand the processes in Industrial & Commercial environment. This will enable to become familiar and to understand various Business processes, Structures, their functioning and the role technicians will have to perform.

Objective:

After completion of the curricula, the pass outs will able to:

1. Familiarize with environment in the world of work
2. Appreciate the importance of management process in Business.
3. Identify various components of management.
4. Understand the role & responsibilities of a Technician in an Organization.
5. Appreciate the rules and regulations pertaining to work ethics and Social Responsibilities.

LEARNING STRUCTURE:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Overview of Business** 1.1. Types of Business • Service • Manufacturing • Trade 1.2 Globalization • Introduction 1.3 Intellectual Property Rights (I.P.R.) Advantages & disadvantages with respective to India	(03) 01 01 01	06
02	**Evolution of Scientific Management** 2.1 Evolution of Management • Concept and definition of management • Levels of management • Administration & management • Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management • Planning • Organizing • Directing • Controlling 2.4 Organizational Management • Introduction to Organization, • Types of organization: Line, Line & staff, Functional Project • Centralized & Decentralized, Authority & responsibility Span of Control 2.5 Forms of ownership • Proprietorship, Partnership, Joint stock, Co-operative Society, Govt. Sector	(07) 01 01 01 02 02	10
03	**Human Resource Management** 3.1 Personnel Management: Definition and Functions 3.2 Staffing • Introduction to HR Planning • Recruitment Procedure 3.3 Personnel • Training & Development • Types of training • Skill Enhancement 3.4 Leadership • Leadership & Motivation • Maslow's Theory of Motivation	(09) 01 01 02	15

	• Front Line Supervisor • Group Dynamics. 3.5 Safety Management • Causes of accident • Safety precautions • Industrial hygiene 3.6 Introduction to Factory Acts • ESI Act • Workmen Compensation Act • Industrial Dispute Act.(Introductory approach only)	02 02 01	
04	**Financial Management** 4.1 Objectives & Functions, 4.2 Capital Generation & Management • Types of Capitals • Sources of raising Capital 4.3 Budgets and accounts • Types of Budgets • Production Budget (including Variance Report) • Labour Budget • Introduction to Profit & Loss Account (only concepts) 4.4 Introduction to • Excise Tax • Service Tax • Income Tax • MOD-VAT • Custom Duty (Introductory approach only)	(09) 01 03 03 02	12
05	**Materials Management** 5.1 Inventory Management -Meaning & Objectives. ABC Analysis Economic Order Quantity, Introduction & Graphical Representation. 5.2 Purchase Procedure, Objects of Purchasing, Steps in Purchasing 5.3 Modern Techniques of Material Management • Introductory treatment to JIT / SAP / ERP. (Introductory approach only)	(06) 03 02 01	10
06	**Marketing Management** 6.1 Introduction The Market, types of market, marketing process selling vs. marketing, stress on customer centric approach. 6.2 Marketing Segmentation: benefits, marketing information system, Objectives of Marketing research, 6.3 Primary and Secondary data, Survey method, Uses of survey method, Types of survey, observation approach, panel research, experimental research, scope for	(08) 01 02 02	12

	marketing research in India. 6.4 Sales Promotion only concept**,** importance of advertisement in marketing, Media selection, channels of distribution, 6.5 Emergence of global marketing, international marketing environment, Multinational companies, procedure of export. (Introductory approach only)	02 01	
07	**Project Management** 7.1 Project Management: Introduction ,CPM & PERT Technique Concept of Break Even Analysis (only introductory), Progress tracking with the help of bar charts. 7.2 Quality Management Definition and concept of Quality , concept of Quality , Quality Circle, Quality Assurance, TQM, Kaizen, 5 'S', & 6 Sigma. (only introductory). (Introductory approach only)	(6) 03 03	15

List of Practicals:

The practical in management may consist of following task,

1.0 Case studies.
2.0 Guided Presentation.
3.0 Management Games.
4.0 Surveys.
5.0 Data collection, Presentation and Interpretation.
6.0 Role play/Group Discussions.

1.0 Case Study :

The case study approach may be applied to following subtopics of the curriculum.
The concern teacher may select similar suitable topics for case study.
(Any Two case studies and its presentation)

- Types of Business
- Intellectual Property Rights (I.P.R.)
- Forms of ownership
- Training & Development
- Leadership & Motivation
- Group Dynamics
- Industrial hygiene
- Sources of raising Capital
- Budgets and accounts
- MOD-VAT
- Modern Techniques of Material Management
- Marketing Segmentation
- Sales Promotion
- Quality Management

2.0 Guided Presentation (Any two)

- Centralized & Decentralized, Authority & responsibility span of Control
- Skill Enhancement
- Safety Management
- Budgets
- JIT / SAP / ERP
- Advertisement in marketing,
- Media selection
- Global marketing
- Quality Management.
- Progress tracking

3.0 Management Games (Any two games from following areas or like wise)

- Human Resource Management
- Marketing Management
- Materials Management
- Project Management
- Lateral Thinking

4.0 Surveys (Any one survey form following areas or like wise)

- Training & Development
- Causes of accident
- Industrial Dispute
- Sources of raising Capital
- Inventory Management
- Customer centric approach by various business houses.
- Sales Promotion
- Product Mix
- Media selection
- Role of Multinational companies
- Impact of Quality Management parameters on project.

5.0 Data collection, Presentation and Interpretation
(Any one form following areas or like wise)

- Training & Development
- Capital Generation & Management
- Inventory Management
- Sales Promotion
- Media selection
- International marketing environment
- Channels of distribution
- Project Management
- Quality Management Parameters

5E306 Instrumentation Techniques (ITC)

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	05	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Know different types of errors & reduction of errors in instruments.
- Construction & Principle of Different transducers used in the measurement of Temperature/pressure/displacement/flow/strain etc.
- Study the principle of data transmission & telemetry.
- Know various display systems suitable for measurement.

Rationale:

Many industries use different transducers for measuring different quantities like temperature, pressure, displacement etc. An Electrical Engineer ,many times, has to work in maintenance dept. where he is required to handle these transducers & display systems. The subject introduces all these concepts to the students.

Objectives :

- Reduce errors in measurement.
- Select proper transducer for particular measurement.
- Use different display systems.
- Study characteristics of different transducers**.**

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Instrumentation Fundamentals** 1.1 Basic Terminologies like Error , Accuracy , Precision , Sensitivity , Repeatability, Reliability 1.2 Different types of Errors 1.3 Sources of errors in instrument, reduction of errors.	05	08
02	**Transducers** 2.1 Transduction - Principle & types 2.2 Resistive , Inductive & capacitive transducers 2.3 Selection of transducer for different applications like Temperature, Flow, pressure & displacement.	03	05
03	**Temperature measurement** 3.1 Construction , working , operation & advantages/disadvantages of Resistance thermometer 3.2 Thermocouple & Thermister. 3.3 Industrial applications of the above	05	08
04	**Displacement Measurement** 4.1 Transducers for measurement of linear & angular	05	08

	displacement like LVDT , RVDT 4.2 Synchros & potentiometer. 4.3 Industrial applications of the above		
05	**Pressure and Flow Measurement** 5.1 Pressure gauges , Bourden tube , Bellows , diaphragm , strain gauges (Bonded metal wire & Bonded metal foil type) 5.2 Measurement of flow : Venturimeter , Rotameter , Electromagnetic flow meter 5.3 Industrial applications of the above	10	18
06	**Display Systems and Recorders** 6.1 Study of LCD , 7 segment & 16 segment display systems 6.2 Comparison of different display systems 6.3 Strip chart recorder, X-Y recorder, recorders used for voltage, frequency, energy, reactive power in power station & substation	10	17
07	**Telemetry System and Transmitters** 7.1 Introduction to Telemetry 7.2 Fundamentals of R-F telemetry , Block diagram 7.3 Basic components of Telemetry , 7.4 Methods of Modulation , 7.5 Power line carrier communication 7.6 Applications of Frequency division & Time division multiplexing. 7.7 Transmitter - Basic principles , types & applications	05	08
08	**Controllers** 8.1 Applications of transducers in Industry for ON/OFF Control 8.2 Basic concept & applications of controller.	05	08

Teaching resources: Notes , Text books , Ref. books ,

Teaching methodology: Discussion , Industrial visit , class-room session

LIST OF PRACTICAL : Minimum 8 practical are to be performed.

1. To plot characteristics of Thermister.
2. To plot characteristics of Thermocouple.
3. Displacement measurement using LVDT.
4. Study of Strain gauge.
5. Angular Displacement measurement using synchros.
6. Study of ON/OFF controller.
7. Study of flow transducer.
8. Study of various display systems.
9. Study of PLCC.(Visit to S/S)

Reference books :

Sr. No.	Author	Title	Publications
1	A.K.Sawhney	A Text book of Elect. Measurement & Instrumentation	Dhanpatrai
2	R.K. Rjput	Electronic Measurements & Instrumentation	S.Chand
3	D.C. Sikdar	Instrumentation & process control	Khanna
4	K. Krishnaswamy	Industrial instrumentation	New Age
5	H.S. kalsi	Electronic Instrumentation	T.M.H.

5E401 D.C. Machines and Transformer (DMT)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	04	Max. Marks	20	80	50	50	--	200
Total credits	08	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Adopts Electrical safety precautions.
- Operate Electrical machines.
- Identify & state the functions of different parts of machines.
- To draw phasor diagram at different loads.
- To connect 3 phase transformers in parallel with proper conditions.

Rationale:

D.C.machine having specific use in areas like Traction, Industrial drives & other applications. Transformer is the heart of Electrical power system. Hence theoretical & practical aspects of d.c. machine and transformer must be known to diploma holders to suit him to work in Electrical industries.

Course objectives:

After study of this course student should be able to….

- Know constructional details of d.c. machines and transformer.
- Know working of d.c. machine as generator and motor.
- Connect machine and transformer and operate it.
- Select particular d.c. machine for particular application.
- Calculate performance parameters for any type of d.c .machines and transformers

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**D.C. Machines** 1.1 Construction & classification 1.2 Lap & Wave Windings 1.3 Comparison between lap and wave winding. 1.4 Working principle of d.c. generator 1.5 E.M.F. equation of d.c. generator, simple numericals 1.6 Armature reaction in d.c. generator & commutation 1.7 Load Characteristics of d.c. shunt generator 1.8 Working principle of d.c. motor. 1.9 Concept of back e.m.f. 1.10 Voltage equation and Torque equations in d.c. motor (simple numericals) 1.11 Characteristics & applications of d.c. motor 1.12 Necessity & types of starters, speed control of	18	24

	d.c.motor		
02	**Single Phase Transformer** 2.1 Working principle 2.2 Construction in detail & classification based on winding placement, Voltages, methods of cooling & application/use of transformer. 2.3 E.M.F. equation, transformation ratio. 2.4 Specifications, KVA rating 2.5 Concept of Ideal transformer and Vector diagram 2.6 Transformer on "No Load" with Vector diagram 2.7 Transformer "On Load" with Vector diagrams 2.8 Equivalent circuit 2.9 O.C. & S.C test 2.10 Losses , Efficiency and regulation 2.11 Efficiency and regulation by direct loading 2.12 Condition for maximum efficiency 2.13 Polarity of transformer 2.14 All day efficiency 2.15 Simple numericals based on above except 2.7	32	36
03	**Three Phase Transformer** 3.1 Construction 3.2 Comparison of three phase transformer with a bank of three single phase transformer 3.3 Different connections (y-y, y-Δ, Δ-Δ,Δ-y) 3.4 Vector groups	08	12
04	**Special Transformer** 4.1 Auto transformer (1Φ & 3 Φ) 4.2 Advantages of auto transformer 4.3 Comparison of auto transformer with two winding transformer	06	08

List of practical (any ten)

1. To know your machine laboratory & To draw the panel diagram of d.c. machine.
2. To study constructional details of d.c. machine and identify its parts.
3. To conduct load test on d.c. shunt generator & plot V-I characteristics
4. To study the three point starter.
5. To reverse the direction of rotation of a d.c. shunt motor.
6. To control the speed of d.c. shunt motor (flux control)
7. To control the speed of d.c. shunt motor (armature Voltage control)
8. To find transformation ratio of single phase transformer.
9. To conduct No load test on a 1 Φ transformer and draw its phasor diagram.
10. To conduct O.C. & S.C. tests on single phase transformer.
11. To find efficiency and regulation of transformer by direct loading method.

Reference Books:

Sr. No.	Author	Title	Publication
1	B.L. Thereja	Electrical Technology –Vol.-2	S.Chand
2	Nagrath Kothari	Electrical machines	TMH
3	J.B. Gupta	Theory and performance of electrical machines	S.K. Kataria & sons

5E402 A.C. Machines (ACM)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	04	Max. Marks	20	80	50	50	--	200
Total credits	08	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Adopts Electrical Safety Precautions.
- Operate Electrical Machines (eg. Three phase /single phase induction motors and synchronous motors & alternators).
- Identify & State the functions of different parts of machines.
- To draw phasor diagram at different loads.
- To connect alternators in parallel with proper conditions

Rationale:

This subject is intended to teach students facts, concepts, and principles of operations of electrical machines such as induction motor, alternator and synchronous motor. These machines are widely used in industries and for generation of electricity. The knowledge of these machines are useful for study of various electrical courses and manufacturing process in industries.

Course objectives:

After study of this course student should be able to….

- Know constructional details of a.c. machines.
- Know working of a.c. machine as alternator and motor.
- Connect machine and operate it.
- Select particular a.c. machine for particular application.
- Calculate performance parameters for various types of a.c .machines

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Three Phase Induction Motor** 1.1 Construction of 3-phase Induction Motor. 1.2 Types – Squirrel cage Induction Motor & Slip ring induction Motor. 1.3 Production of rotating magnetic field. 1.4 Principle of working/operation. 1.5 Concepts of synchronous speed, Actual speed, slip speed & slip. 1.6 Expression of rotor frequency, rotor emf & rotor current under steady state and running conditions.(Simple numericals on topic 1.5 & 1.6) 1.7 Relation between torque and rotor power factor.	25	30

	1.8 Starting torque. 1.9 Starting torque of squirrel cage Induction Motor & starting torque of slip ring induction motor. 1.10 Condition for maximum starting torque 1.11 Torque under running conditions 1.12 Condition for maximum Torque under running 1.13 Torque slip characteristics of 3-ph Induction motor. 1.14 Relation between full load torque & maximum torque (Derivation) 1.15 Relation between starting torque & maximum torque 1.16 Measurement of slip by (a) Tachometer (b) Galvanometer 1.17 Power stages in 3-ph Induction motors 1.18 Relation between Torque, mechanical power, rotor output, Rotor input, Rotor Copper losses. (Numerical based on 1.18) 1.19 Speed control of Induction motor by (a) Pole changing method (b) Frequency control method (c) Rotor resistance control. 1.20 Necessity of starter 1.21 Starting of 3-ph Induction motor with (a) DOL starter (b) Star-Delta starter (c) Autotransformer starter (d) Rotor- Resistance starter 1.22 Applications of Squirrel cage Induction motor & slip ring Induction motor. 1.23 Principle of Double cage induction motor		
02	**Single Phase Induction Motor** 2.1 Types of single phase induction motor 2.2 Starting of single phase Induction motor 2.3 Resistance split phase Induction. 2.4 Capacitor start, Induction Run Induction motor. 2.5 Capacitor start, capacitor run Induction motor. 2.6 Shaded pole induction motor. 2.7 Applications of all above motors	05	08
03	**Three Phase Alternator** 3.1 Basic principle of Alternator 3.2 Construction of 3-ph Alternator (a) Armature (b) Rotor – Smooth cylindrical & Projecting type 3.3 Advantages of rotating field. 3.4 Brief Introduction to Armature winding 3.5 Pitch factor & distribution factor	19	22

	3.6 E.M.F. equation of an alternator (simple numericals) 3.7 Alternator on load, voltage drop due to Armature resistance, Armature leakage reactance & armature reaction 3.8 Armature reaction and it's effects according to power factor 3.9 Concept of synchronous reactance & synchronous impedance 3.10 Vector diagram of loaded alternator with different types of load power factor 3.11 Determination of voltage regulation by- (a) Direct loading method (b) Synchronous impedance method (simple Numericals) 3.12 Necessity for parallel operation of alternator 3.13 Conditions to be satisfied for parallel operation of alternator 3.14 Synchronizing of alternator by one dark two bright lamp method and synchroscope method.		
04	**Synchronous Motor** 4.1 Principle of working/operation 4.2 Synchronous motor on load with constant excitation 4.3 Synchronous motor with different excitation 4.4 Concept of load angle, machine angle and pf angle 4.5 Different torques in synchronous motor 4.6 V curve and inverted V curve 4.7 Hunting/phase swinging 4.8 Starting of synchronous motors 4.9 Comparison between synchronous & induction motor 4.10 Applications of synchronous motor	12	16
05	**Special Types of Motors** 5.1 Introduction to Linear Induction motor 5.2 Introduction to Stepper motor 5.3 Introduction to Induction Generator	03	04

List of Practicals: (Any ten)

1. To know the A.C. Machine laboratory
2. Starting and reversing of three phase induction motor
3. Starting and reversing of single phase induction motor
4. Measurement of slip of 3-ph I.M. by Galvanometer & tachometer method
5. Load test on 3-ph Induction motor

6. Starting of 3-phase slip ring –I.M. using rotor resistance starter.
7. Starting of 3-phase squirrel cage I.M. by manual type star-delta starter.
8. To study constructional details of alternator.
9. Determination of regulation and efficiency of 3-phase alternator by direct loading method.
10. Study of the effect of load and load p.f. on the voltage of a three phase alternator.
11. Determination of regulation of 3-ph alternator by synchronous impedance method
12. Study of different method of starting of synchronous motors.
13. Determination of relation between excitation and armature current ; excitation and p.f. of synchronous motor..

Reference Books:

Sr. No.	Author	Title	Publication
1	B.L. Thereja	Electrical Technology –Vol.-2	S. Chand
2	V.K. Mehta	Electrical machines	S. Chand
3	J.B. Gupta	Electrical Technology –Vol.-2	S.K. Kataria & sons
4	Nagrath Kothari	Electrical machines	TMH

5E403 Switchgear and Protection (SGP)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Ability to apply working principles and salient features of switchgear and protection in different sectors
- Ability to understand the concepts, principles involved in construction and working of protective switchgear system and maintain them by taking decision in different situations.
- Ability to use and adopt proper safety devices/procedures in case of abnormal conditions.
- Ability to get conversant with detailed technical specifications of switchgear and protective equipments.

Rationale:-

In modern world electrical power system is growing fast. a diploma holder employed in the field of generation, transmission and distribution has to take precaution for ensuring uninterrupted power supply to the consumer . He is responsible for safety of the personnel and equipments under his control, he should know the procedure to be adopted in case of break down or fault or any abnormal conditions. He should know the protective devices used for safety of personnel and various power system equipments.

The course is designed to understand the concepts, principles involved in construction and working of switchgear and protective devices and to prepare technicians /supervisors to carry out this responsibility in day to day work.

Course objectives:-

Student should be able to

- Learn the principles, concepts and procedural aspects of switchgear and protection.
- Identify the various components of switchgear and protection systems.
- Know the specifications and select switchgear and protection system
- Identify the faults and knowledge of repairing procedures.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Fundamental Elements of Protection** 1.1 Normal and abnormal operation of power system 1.2 Types of faults and causes of faults 1.3 Short circuit KVA calculation for symmetrical faults (simple numericals) 1.4 Use of current limiting reactors, types and their arrangements 1.5 Functions of protective system and elements of protective system. 1.6 Back- up protection, methods of back up protection	08	10

	(Relay back up, Breaker-back up, Remote back up)		
02	**Circuit Interrupting Devices** 2.1 Fuse 2.1.1 Fuse element materials and their desirable properties 2.1.2 Construction, working, characteristics, application and specification of semi enclosed Rewirable and HRC fuses 2.2 Isolator- Construction, working of vertical break and horizontal break isolator with their applications 2.3 Circuit breaker 2.3.1 Arc formation process in C.B. 2.3.2 Methods of arc quenching (High resistance method and Low resistance or current zero method) 2.3.3 Concept of Arc voltage, Re striking voltage & Recovery voltage 2.3.4 Circuit breaker rating- (Breaking capacity, Making capacity, Short time rating) 2.3.5 HT CBs-Concept, working principle, construction, specifications and applications of MOCB, sulphur hexa fluoride (SF6), vacuum circuit breaker 2.3.6 LT CBs-working, specifications and applications of air circuit breaker, MCB, MCCB, ELCB 2.3.7 Various technical terms and specifications of CB	16	20
03	**Neutral Grounding** 3.1 Necessity and importance of neutral grounding, advantages of neutral grounding 3.2 Methods of neutral grounding and their applications 3.3 Comparison between different methods of grounding	04	05
04	**Protective Relays** 4.1 Concept of the term protective relay 4.2 Fundamental requirements (qualities) – selectivity, speed, sensitivity, reliability, simplicity, economy 4.3 Basic relay terminology- Relay time, pick up current, plug setting multiplier, time setting multiplier 4.4 Classification of relays based on principle of operation/applications 4.5 Electromagnetic attraction relays- operation of attracted armature type, solenoid type and balanced beam type relays	12	16

	4.6 Electromagnetic induction type- operation of shaded pole and watt-hour meter type relays 4.7 Induction type over current relay (non-directional) and induction type directional power relay 4.8 Distance (impedance) relay (operation) 4.9 Differential relay- operation of current differential relay and voltage differential relay 4.10 Need, advantages and limitations of static relay 4.11 Operation of static over current relay with block diagram 4.12 Operation of thermal relay		
05	**Protective Systems** 5.1 Protection of alternator 5.1.1 Abnormalities and faults 5.1.2 Differential protection 5.1.3 Balanced earth fault protection 5.1.4 Stator Inter turn protection 5.1.5 Field failure protection 5.2 Protection of Transformer 5.2.1 Abnormalities and faults 5.2.2 Differential and biased differential protection 5.2.3 Earth fault or leakage protection 5.2.4 Restricted earth fault protection 5.2.5 Buchholz relay 5.3 Protection of motor 5.3.1 Abnormalities of faults 5.3.2 Short circuit protection 5.3.3 Overload protection 5.3.4 Under voltage protection 5.3.5 Reverse phase protection 5.4 Protection of Bus bars and transmission line 5.4.1 Bus bar protection – operation of differential protection and fault bus protection 5.4.2 Transmission line protection- over current protection, distance protection and differential pilot wire protection	18	20
06	**Over Voltage Protection** 6.1 Over voltage and causes of over voltages 6.2 Voltage surge 6.3 Lighting stroke and protection against lighting 6.4 Types of L.A. – Rod gap, Horn gap, Expulsion, Multi gap, Thyrite type L.A. 6.5 Surge absorber 6.7 Volt- time characteristics & insulation coordination	06	09

List of Practicals: (Any eight)

1) To study different switch gear equipments used in electrical power system / switchgear and protection lab.
2) To identify the components of different types of circuit breakers with their specifications (through visits/ video / model).
3) To study various types of over current relays and to plot the performance characteristics of an over current relay.
4) To understand the protection schemes of alternator and to sketch labeled schematic diagram of various types of protection of alternator.
5) To understand the protection schemes of transformer through visit to local high voltage substation and to sketch labeled schematic diagram of various types of protection of transformer.
6) To understand various types of neutral earthings and specifications of earthing at different substations/different locations and new trends in earthing (information search).
7) To understand types and specifications of lighting arrestors of different manufacturers through brouchers/literature.
8) To perform experiments for a given 3 phase induction motor with direct on line (DOL) starter
   a) To check the operation of DOL starter under short circuit condition.
   b) To check the operation of single phasing preventer by creating single phasing fault.
   c) To check the operation of over current relay for various loads.
9) To Study & Observe arc quenching by lengthen the arc.

Reference books :

Sr. No.	Author	Title	Publication
1	S.Rao	Switch gear & protection	Khanna Publications
2	Soni, Gupta & Bhatnagar	A text book on electrical power sysyem	Dhanpat Rai & Sons
3	Mason C.R.	The art & science of protective relaying	Wiely Eastern
4	S.L. Uppal	A text of Electrical power	Khanna publishers
5	Badriram & Vishwakarma P.N.	Power system Protection & switchgear	TMH
6	V.K.Mehta	Principles of power systems.	S.Chand

5E404 Distribution and Utilisation of Electrical Energy (DUE)

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	05	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):
Draw, read and interpret circuit diagrams, drawings and layouts related to electrical engineering. Supervise various operations of Electrical power utilization systems.

Rationale:
Electrical energy is distributed at various levels according to requirement. Diploma holder has to deal with various stages like erection, maintenance, fault location of simple distribution schemes, supervisory controls in power system utilisation. He should learn all above aspects in this course.

Course Objectives
Student should be,
- Able to draw ,read & interpret layout diagrams.
- Know mechanical and Electrical details of distribution system.
- Know the utilization of electrical energy in various areas.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Distribution Systems** 1.1 Introduction 1.2 Classification of distribution systems 1.3 A.C. distribution (Primary and secondary distribution system) 1.4 Connection schemes of distribution systems (Radial, ring main and interconnected systems) 1.5 Requirements of distribution system 1.6 A.C. distribution calculations 1.7 Methods of solving A.C. single phase and three phase connected balanced distribution systems with numericals	05	08
02	**Underground Power Cables** 2.1 Introduction and requirements 2.2 Cable construction 2.3 Insulating materials for cables 2.4 Classification (Only List) 2.5 Laying of underground cables	03	06
03	**Substations** 3.1 Introduction/ requirements 3.2 Classifications	07	10

	3.3 Advantages and disadvantages 3.4 Selection and location of site 3.5 Pole mounted substation 3.6 Indoor and outdoor substations 3.7 Symbols for equipments in substation 3.8 Equipments used in substation (brief description) 3.9 Layout of 33/11 kV distribution substation		
04	**Electric Drives** 4.1 Advantages and disadvantages 4.2 Individual and group drive 4.3 Selection of a electric motor for a particular application 4.4 Duty cycle 4.5 Size and rating of electric motor	03	06
05	**Electric Heating** 5.1 Advantages 5.2 Modes of heat transfer (Conduction, convection and radiation) 5.3 Types of electric heating 5.4 Resistance heating (Construction and operation) 5.4.1 Direct resistance heating – salt bath furnace 5.4.2 Indirect resistance heating – resistance ovens 5.4.3 Requirement of heating elements 5.4.4 Causes of failure of heating elements 5.5 Applications of resistance heating 5.6 Arc heating (Construction and operation) 5.6.1 Direct arc furnace 5.6.2 Indirect arc furnace 5.7 Applications of arc heating 5.8 Induction heating (Construction and operation) 5.8.1 Direct core type induction furnace 5.8.2 Indirect core type induction furnace 5.9 Applications of induction heating 5.10 Dielectric heating – principle, advantages, disadvantages and applications	12	20
06	**Electric Welding** 6.1 Definition 6.2 Resistance welding – principle, advantages, disadvantages and applications 6.3 Types of resistance welding (only list) 6.4 Electric arc welding – principle, advantages, disadvantages and applications 6.5 Comparison of resistance and arc welding	04	08
07	**Electric Traction** 7.1 Requirements of an ideal traction system 7.2 Systems of track electrification	14	22

	7.2.1 D.C. system 7.2.2 Single phase A.C. system 7.2.3 Three phase A.C. system 7.2.4 Composite system 7.3 Overhead equipments 7.3.1 Catnary construction 7.3.2 Current collecting equipments 7.4 Block diagram of A.C. locomotive 7.5 Traction motors 7.5.1 Desirable characteristics of traction motors 7.5.2 Suitability of D.C. sries motor for traction 7.5.3 Suitability of three phase induction motor for traction 7.5.3 Suitability of linear induction motor for traction 7.6 Power supply arrangements 7.6.1 Constituents of supply system 7.6.2 Substations 7.6.3 Feeding posts 7.7 Braking 7.7.1 Requirements of braking system 7.7.2 Types of braking (Only List) 7.7.3 Electric braking – Rheostatic and regenerative braking (No derivation, no numericals)		

Practicals

1) Information search through books, print media, internet about existing primary and secondary distribution systems
2) Information search through books, print media, internet about H.T. & L.T. underground cables
3) Industrial visit and report on 132 kV/ 33 kV substation
4) Information search through books, print media, internet about Electric heating
5) Information search through books, print media, internet about A.C. locomtive

Reference Books:

Sr. No.	Author	Title	Publication
1	V.K. Mehta	Principles of power system	S. Chand
2	Soni, Gupta, Bhatnagar	Electrical power system	Dhanpat Rai & sons
3	H Partab	Utilization of electrical energy	Khanna publications
4	J.B. Gupta	Utilization of electrical power and electric traction	S. Kataria & sons
5	G.C. Garg	Utilization of electrical power and electric traction	Khanna Publications

5E405 Testing and Maintenance of Electrical Equipments (TME)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Testing and maintenance of electrical equipment as per ISS.
- Fault finding & trouble shooting of electrical installations & machines.
- Knowledge about electrical safety.

Rationale:

The course aims as the diploma holder of electrical engineering generally working in industry or in MSEGCL, MSETCL, MSEDCL where he is expected to do the routine and preventive maintenance of electrical equipments, to inspect and assist in testing the commissioned equipments as per I.S. and to install the machines as per manufactures instructions. As an Electrical In charge of substation/ subdivision or any electrical installation, he has to know the I.E. act and regulations for safety of equipments and persons working under him.

Course objectives:

- Carry out testing & maintenance of electrical equipments as per I.S.
- Measure the insulation resistance & know the methods of improving insulation resistance if required.
- Locate common troubles, analyze & set it right in case of various electrical machines.
- State the importance of safety precautions.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**General Introduction** 1.1 Routine, preventive and breakdown maintenance, reasons for failure of electrical equipment. 1.2 Advantages of preventive maintenance and importance of planning of preventive maintenance programme. 1.3 Procedure for developing preventive maintenance schedule. 1.4 Factors affecting preventive maintenance schedule. 1.5 Objectives of testing, routine, type and special tests. 1.6 Various methods of testing: Direct method, Indirect method, Regenerative testing for efficiency and temperature rise. 1.7 Electrical & mechanical tests before commissioning (only list) 1.8 Significance of ISS.	08	10

	1.9 Definition of tolerance, Limit of voltage, current, frequency and speed for safe working of electrical machines.		
02	**Testing of Machines** 2.1 Testing of three phase Induction Motor - No load test, Blocked rotor test, Full load test, Reduced voltage running up test 2.2 Testing of single phase Induction Motor - No load test, Blocked rotor test 2.3 Testing of Single phase transformer - Direct loading test, Back to back test, Polarity test 2.4 Testing of D.C. Machines Brake test, Swinburn's test, Hopkinson test 2.5 Reasons for gradual loading 2.6 Simple numericals on above	14	18
03	**Insulation Testing** 3.1 Classification of Insulating materials as per I.S.8504 3.2 Factors affecting life of the insulating material. 3.3 Measurement of insulation-resistance. 3.4 Method of cleaning insulation covered with loose, dry dust, sticky dirt, oily, viscous films. 3.5 Procedure for varnishing insulation, vacuum impregnation. 3.6 Method of external/internal heating. 3.7 Methods of measuring temperature of internal parts and winding of machine, 3.8 Properties of good transformer oil. 3.9 List of agents which contaminate the insulating oil. 3.10 Procedure for following tests on oil as per IS Dielectric strength test, Acidity test, Sludge test, Flash point test, Crackle test 3.11 Protection of electrical equipments during periods of inactivity.	13	15
04	**Preventive Maintenance** 4.1 Importance of preventive maintenance schedule. 4.2 Identifying the faults which are due to poor or absences of maintenance. 4.3 Maintenance schedule of following: i) Distribution transformer as per IS1886-1967 ii) Induction motor as per IS 900-1965 iii) Synchronous machines as per IS 4884-1968 iv) Switchgear and control equipments as per IS 3072-1975 v) Storage batteries as per IS 4237-1967	08	10

05	**Trouble Shooting of Electrical Equipments** 5.1 Condition for normal performance of electrical equipments. 5.2 Significance of trouble shooting in various electrical machines. 5.3 Internal/External causes for failure/abnormal operation of equipment. 5.4 Reasons for occurrence of electrical, mechanical and magnetic faults. 5.5 Use of following tools: Bearing puller, Filler gauge, Dial indicator, Spirit level, Megger, Earth tester, Multi meter, Growler 5.6 Need of trouble shooting charts in maintenance. 5.7 Preparation of trouble shooting charts for…. Three phase Induction motor, Single phase Induction motor, Single and three phase transformer, D.C. motor. 5.8 Common troubles in machines & equipments	11	12
06	**Prevention of Accidents and Safety Precautions** 6.1 Indian electricity Act and Statutory regulations for safety of persons and equipments, while working with electrical installations 6.2 Do's and don'ts listed in IS for substation operation. 6.3 Factors on which severity of shock depends. 6.4 Procedure for rescuing a person who has received an electrical shock. 6.5 Demonstration of methods for providing artificial respiration correctly. 6.6 Procedure for shut down of substation and power line such as: Announcement of shut down, obtaining permit to work, Isolation of line and system, carrying out the maintenance work, charging of the line after completion of work. 6.7 Precautions to be taken to avoid fire due to electrical reasons. 6.8 How to operate fire extinguishers. 6.9 Introduction to Total Productive Maintenance. 6.10 Factors affecting Total Productive Maintenance	10	15

LIST OF EXPERIMENTS: (All Compulsory)

1. To perform polarity test on single phase transformer.
2. To perform Swinburn's test on D.C. shunt motor.
3. To perform back to back test on two single phase transformers
4. To perform reduced voltage running up test of a three phase Induction motor.
5. To perform no load test on single phase Induction motor.

6. To conduct testing of transformer oil as per ISS.
7. To prepare trouble shooting and rectifying the troubles in transformer.
8. To prepare trouble shooting and rectifying the troubles in Induction motor.
9. To prepare trouble shooting and rectifying the troubles in D.C. Motor.
10. To perform testing of armature for a open or short circuited armature coil with the help of Growler.

Reference books :

Sr. No.	Author	Title	Publication
1	B.P. Patil	Testing & maintenance of electrical equipment	Nirali
2	S. Rao	Testing commissioning & maintenance of electrical equipment	Khanna
3	M.V. Deshpande	Design & testing of electrical machines	PHI Learning
4	B.V.S.Rao	Preventive maintenance of electrical machines & equipments Vol I & II	Media Promoters

5E406 Installation, Estimation and wiring (IEW)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	50	--	25	175
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Draw, read and interpret circuit, wiring diagrams, drawing and layouts related with electrical engineering.
- Prepare estimates of electrical installation & wiring
- Electrical safety practice.

Rationale:

The course aims as the diploma holders of electrical engineering working in various industries, MSETCL, MSEDCL Contracting firms etc. have to select the proper equipments and materials, prepare their estimates with their costs. If the general procedures for such estimation and costing are known to the students, they can apply these procedures in different situations and for different purposes. The topics of service connection, residential wiring, industrial wiring and commercial Wiring are incorporated in this course with a view that the students will prepareThe estimates with costing, draw wiring diagram and layout of the scheme etc.

Course objectives:

The student will be able to

- Choose proper wiring components and systems as per requirement.
- Be aware of electrical hazards and safety precautions.
- Prepare estimates in details for wiring schemes along with sketches.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Installation** 1.1 Tools and accessories required for installation work 1.2 Introduction to Indian Electricity rules relating to transmission and distribution lines and domestic installation regarding: Service lines, cutout on consumers premises, Identification of earthed and earthed neutral terminal as defined under rule 58, supply to consumers, provision applicable to medium, high, extra high voltage installation, declared voltage of supply. Frequency of supply to consumer, connection with earth. Clearance from ground of lowest conductor,	28	34

	clearance from buildings of low and medium voltage lines and high voltage lines, clearance from high and extra high voltage lines etc. 1.3 Types of electrical installation: Residential, Commercial installation, Installation drawing and their interpretation 1.4 Electrical installation of medium size industrial complex. 1.5 Installation of transmission and distribution lines erection of steel structures, connection of jumpers joints and dead ends, crossing of roads, power/telecommunication lines, railway crossing, clearance, earthing of equipment and grounding, spacing and configuration of conductors, arrangement for suspension and strain insulators, bird guards anti- climbing devices and danger plates, size of conductors earth wires and guy wires. 1.6 Installation of bus bars, switchgear, safe method of cable laying, safe method of jointing multi core cable, general precautions to be taken to avoid electrical hazards in cables. 1.7 Requirements of different dimensions of foundation for i) Static machinery ii) Rotating machinery, Factors which decide machine foundation and procedure of leveling and alignment, effect of misalignments. Purpose of earthing and installation (plate and pipe), maximum values of earth resistance for different installations such as power stations, substations, domestic installation, overhead installation, method of reducing earth resistance.		
02	**Estimation and Wiring** 2.1 Concept of estimation: Purpose, approximate estimate, rate analysis, labor Cost. 2.2 Wiring systems: Types, installation methods. 2.3 Estimation of service connections for residential installation: 2.3.1 Service connection for single storey buildings. 2.3.2 Service connection for double storey buildings 2.3.3 Underground service connection	26	32

	2.4 Residential wiring, Rules for residential wiring , Rating of different apparatus such as lamps, fans, socket outlet, fuses, switches, MCB, ELCB, Junction box and looping in system, Simple diagram of single phase installation and three phase installation tree system, Neutral wire and earth wire. Sub-circuits- Light and power sub-circuits. Load assessment, Permissible voltage drops and size of wires , Estimation and costing of electrical installation in a two and three room flat. 2.5 Industrial Wiring: Rules for industrial wiring, Motor circuit wiring, Design considerations- Motor current, selection of cable, size of conduit, fuse rating, selection of starter, distribution board, main switch, location of motor, Estimation and costing of industrial wiring. (Max. up to 4 motors only)		
03	**Principles of Contracting** 3.1 Concept of contract and tendering: Contracts, contractor, tender and tender notice. 3.2 Procedure for inviting tenders, procedure followed by contractor to fill the tender and for the award of work order. 3.3 Preparation of tender documents, Concept of following terms: i)Schedule of material, ii) Schedule of cost, iii) Valid contract, iv) Earnest money deposit v) Security deposit, vi) Comparative statements. 3.4 Permit system: Introduction to permit system, precaution to be taken, by issuer of permit, logging of permit issue and return, precautions to be taken when working with permit.	10	14

LIST OF PRACTICALS:

1) Draw different Symbols used in wiring.
2) Draw layout of service connection and estimation report of Overhead line and underground line.
3) Draw layout of residential unit and prepare visit report for residential unit.
4) Draw layout of commercial building and prepare visit report for commercial building.
5) Preparation of tender documents.
6) Visit to newly constructed building from electrical installation point of view.

Note: Drawing sheet of full imperial size shall be used.

Reference books :

Sr. No.	Author	Title	Publication
1	S. L. Uppal	Electrical wiring estimation and costing	Khanna
2	S.K. Bhattacharya	Estimation and costing	New Age
3	B. P. Patil	Electrical Installation system I and II	Nirali
4		Indian Electrical rules	

5E407 Power Electronics (PET)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge of various electronic power devices
- Selection of electronic power devices for various applications
- Use of electronic power devices for control of electrical equipments

Rationale:

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

Course objectives:

Students should be able to

- Describe principle of working of SCR.
- Describe construction, working and application of converters, inverters, and choppers.
- Realize importance of electronic power control.
- Understand electronic control of drives.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Thyristor** 1.1 Construction of Thyristor, 1.2 V-I characteristic of Thyristor 1.3 Turn-on and turn-off characteristics of SCR 1.4 SCR ratings. 1.5 Construction and VI characteristic of LASCR 1.6 Construction and VI characteristic of GTO 1.7 Construction and VI characteristic of RCT 1.8 Construction and VI characteristic of SITH 1.9 Construction and VI characteristic of MOSFET 1.10 Construction and VI characteristic of IGBT 1.11 Traic and Diac characteristics and its applications	12	18

02	**Triggering Circuits** 2.1 Forward voltage triggering 2.2 dv/dt triggering 2.3 Thermal triggering 2.4 Light triggering 2.5 Gate triggering circuits 2.5.1 Gate triggering using R 2.5.2 Gate triggering using RC 2.5.3 Gate triggering using UJT	06	08
03	**Commutation Techniques** 3.1 Natural commutation, 3.2 Forced commutations 3.2.1 Class A commutation 3.2.2 Class B commutation 3.2.3 Class C commutation 3.2.4 Class D commutation 3.2.5 Class E commutation 3.3 dv/dt protection 3.4 di/dt protection 3.5 Snubber circuit 3.6 Crowbar circuit	08	10
04	**Controlled Rectifiers** 4.1 Principal of phase controlled converters, 4.2 Single phase half wave converter with R load 4.3 Single phase half wave converter with R-L load 4.4 Single phase semi-converter with R load 4.5 Single phase full wave converter with R load 4.6 Single phase full wave converter with R-L load 4.7 Concept of freewheeling diode 4.8 Three phase full wave converter with R load.	10	12
05	**Inverters** 5.1 Principle of Operation 5.2 Single-phase series inverter 5.3 Single-phase parallel inverter 5.4 Single-phase Half bridge inverter 5.5 Single phase full bridge Inverter 5.6 Three-phase bridge inverter	10	12
06	**Chopper** 6.1 Principle of operation 6.2 ON-OFF control method, duty ratio, 6.3 Step-up chopper 6.4 Step-down chopper	04	06

07	**A.C Voltage Controller** 7.1 Single phase a.c voltage controller, 7.2 Three-phase a.c voltage controller	06	06
08	**Applications** 8.1 Single- phase Fan Regulator, 8.2 Light dimmer, 8.3 Time delay circuit, 8.4 Light flasher, 8.5 DC circuit breaker 8.6 Uninterruptable power supply	08	08

LIST OF EXPERIMENTS: (Any eight)

1. To identify SCR terminals and test SCR
2. To plot V-I characteristics of SCR
3. To plot V-I characteristics of Diac.
4. To plot characteristic of UJT as triggering circuit.
5. To determine firing angle of commutation circuit.
6. To plot characteristic of firing angle alpha Vs Vdc of single phase converter
7. To plot characteristic of series Inverter
8. To perform lamp flasher circuit.
9. To plot characteristic of step up chopper
10. To plot characteristic of step down chopper.
11. To perform light dimmer circuit
12. To determine the delay time of time delay circuit
13. To study Uninterrupted Power supply system.

Reference books :

Sr.No	Author	Title	Publisher
1	P.S.Bhimbra	Power Electronic	Khanna Publishers Delhi
2	M.H. Rashid	Power Electronics Circuit Devices and Applications	Prentice Hall of India Pvt.Ltd. New Delhi.
3	Dr.M. Ramamurthy	An introduction to thyristor & their applications	East West Press Pvt. Ltd
4	P.C. Sen	Power Electronics	Tata McGraw hill ltd

5E408 Electrical Machine Design (EMD)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Ability to select proper design constants / basic parameters for design of transformers, induction motors, starters etc.
- Ability to apply basic equation for designing transformers, induction motors etc.
- Ability to design very small transformers & chokes.

Rationale:

This course is will help the students who are interested in joining designing fields. The course enables the students to understand basic ideas in designing of transformer, induction motor, starter etc.

Objectives :

The students should able to…

- Design the core, windings & tank of distribution & power transformer.
- Design very small transformer required in domestic applications & chokes of fluorescent tubes.
- Find the resistance of section of starters used for D.C. shunt motors & three phase induction motors.
- Design the stator & squirrel cage rotor of three-phase induction motor.

Contents: Theory

Chapter	Name of Topic	Hours	Marks
01	**Basic Design Considerations** 1.1 Introduction to design, specifications of transformers & rotating machines 1.2 Specific loadings & its importance, effect of material on design, various types of windings & cores.	05	08
02	**Transformer Design** 2.1 Output equations of single phase & three phase transformers, choice of different parameters 2.2 Design of core & yoke, overall dimensions of single phase & three phase transformers, design of windings, selection of type of winding for L.V.& H.V. 2.3 Calculation of resistance & leakage reactance of windings, Temperature rise calculations, cooling of transformers, design of tank , design of cooling tubes.	22	25

	(Visit report on transformer manufacturing company)		
03	**Design of Small Transformer and Choke** 3.1 Complete procedure of core & winding design of small rating transformers. 3.2 Selection of stampings & conductor, numericals Based on above, Design of core & winding of choke.	06	08
04	**Design of Induction Motor** **(Three phase and Single phase)** 4.1 Output equation, Choice of specific electric loading & specific magnetic loading, main dimensions of stator 4.2 Design of stator winding- Number of turns, Number of stator slots, Number of conductors. 4.3 Calculation of length of air gap, selection of rotor slots, rotor turns, rotor Current, area of rotor conductor for squirrel cage induction motors. (Visit to industry)	16	22
05	**Design of Starters** 5.1 Grading of starting resistances for 3 phase slip ring induction motor. 5.2 Design problems based on same, study of soft starters.	08	09
06	**Design of Magnet Coil** 6.1 Hold on coil & overload coil for starter. 6.2 Advantages of computer aided design	07	08

TERM WORK: Any 4 of the following sheets:

1. Design of 3-phase distribution transformer with cooling tubes.
2. Design of very small transformer (e.g 12V,1A)
3. Design of choke.
4. Design of starter for Slip-ring induction motor.
5. Design of welding transformer.
6. Design of 3-phase induction motor & draw half-sectional view.

Reference books :

Sr. No.	Author	Title	Publications
1	A.K.Sawhney	A course in Electrical machine design.	Dhanpatrai
2	R.K.Aggarwal	Principle of Electrical machine design.	S.K. Kataria
3	Mittal	Design of Electrical machine	Standard

5E409 Computer Aided Design (CAD)

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	25	25	--	50
Total credits	02	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- To understand drafting software
- To inculcate skills of AutoCAD
- To undergo various command in AutoCAD
- To know about plotting and drawing with annotations

Rationale:

Due to rapid changes in technologies, the concept of drawing sheets with the drawing instruments such as drafters and compass, are getting obsolete and the advanced drafting software are taking its place.

Drafting software is getting more importance in industrial sectors as number of advanced drafting software are used by them. All the technicians come across this software in different way.

Therefore it is the need of the time that every technician should know the various commands of the drafting software.

The basic drafting software AutoCAD is dealt with this course.

Course objectives:

Student should able to,

- Understand different AutoCAD environment
- Get acquainted with various AutoCAD commands
- Obtain skills in the drafting.
- Know plotting and printing commands.
- Concept of layers and line types.
- Creating blocks
- Get knowledge of various components of computers.

LIST OF PRACTICALS:

The drawings drawn using autocad shall be of various parts of electric machine, transformer, various electrical components such as resistance, inductance, starters, developed diagram of windings, electrical plans for illumination of a building etc.

1. Introduction to GUI, Menus, pull down menus, tool bars etc .and AutoCAD environment
2. Setting of AutoCAD environment
3. Exercises based on coordinate systems and basic geometric command.
4. Exercises using status bar, object snaps, drawing and editing commands
5. Sketches using Layers and line types.
6. Sketches showing applications of blocks.
7. Plotting the drawings.

Reference books :

Sr. No	Title	Author and Publication
1	Inside AutoCAD	Techno media, 1997 First Edition
2	AutoCAD 2000	Sham Tickoo, Galgotia, 2001 IInd
3	AutoCAD 14	Autodesk
4	Mastering AutoCAD-14	George Omura, BPB, 1997
5	AutoCAD 14 Features	P. Nageshwarrao, TMCGH
6	AutoCAD 2000 for Mechanical	George Omura, BPB,

5E410 PROJECT

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	04	Max. Marks	--	--	100	--	50	150
Total credits	04	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- Ability to design, construct, test a product
- Ability to use skills in producing a final product
- Ability to solve practical problems
- Abilty to locate various sources of technical information

Rationale:

This subject is intended to teach students to understand the facts, concepts and techniques of electrical equipments, its repairs, fault finding and testing, estimation of cost and procurement of material, fabrication and manufacturing of various items used in electrical field. This will help the student to acquire skills and attitudes so as to do the function of supervisor in industry and also can start his/her own small scale enterprise.

Course objectives:

Student should be able to……

- design, construct a final product
- handle, use various different equipment
- develop report writing skills
- develop new innovative ideas and analyse the different types of case studies.

Content outline:

Each batch for Project shall consists of 04-06 students

The project shall be preferably a **working model** and shall be based on various fields in electrical engineering such as…

Electrical Machines, Power Systems, Instrumentation, Software for solving various problems, Fault finding, repairs, modifications in existing setup/units, Electrical Installation systems, Energy conservation, Non conventional energy, magnetic levitation etc.

5E411 SEMINAR (SMR)

Teaching Scheme		Evaluation Scheme						
TH	--		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	50	100
Total credits	02	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- ability to locate various sources of information
- ability to develop a report
- ability to deliver a seminar on the selected topic
- ability to develop presentation skills, stage courage

Rationale:

Diploma holders need to be capable of doing self study through out their life as the technology is developing with fast rate. Students will be able to find out various sources of technical information and as they are going to work in supervisory cadre they should able to explain their views to the group of peoples hence the seminar is intended to the students.

Course objectives:

- student should be able to deliver a seminar
- student should be able to develop report writing skill

content outline:

Each batch for seminar shall consists of 02-04 students

The seminar shall be based on **new technologies and advancements** in the field of electrical engineering.

The group of student shall represent the content through **power point presentation**.

The No. of slides shall be 20-30.

The maximum time allotted for presentation is 20 Minutes.

The group shall submit a report. A copy of which is to be kept with the department.

5E412 Electrical Engineering Drawing and Panel Wiring (EDW)

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	25	75
Total credits	02	Duration (Hrs.)	--	--	--	--	--	--

Competency statement(s):

- Draw, Read and interpret circuits related to Electrical Engineering.
- Selection of Electrical Engineering materials.
- Operate and design simple electrical control circuits.
- Adopt electrical safety practices.
- Select, connect and operate electrical measuring instruments.
- Numerical ability to solve problems.
- Awareness of social responsibilities and work in a groups.
- Update the knowledge and skill to suit to new technology as life long learner.
- Attitude towards initiative, Hardworking & punctuality.

Rationale:

This is the course which every Electrical Engineering student must study before going for higher course in Electrical Engineering and analyzing of electrical circuits which are commonly used in measurement , instrumentation, electronics, machines, electrical power system.

Course objectives:

- Student will be acquainted with the facts of electrical circuits, magnetic circuits, circuit elements, tools, equipments, type of circuits, sources etc.
- Student will know the basic concept of circuits, properties of electromagnetic and electro static fields, a. c. quantities.

List of practicals:

1. To draw various symbols used in field of electrical engineering.
2. To draw the layouts of various laboratories in electrical engineering department.
3. To draw the single line diagram of supply system
4. Visit to a control panel manufacturing industry & prepare report on different activities performed during panel manufacturing
5. Develop a control circuit for forward and reverse direction for a d.c. shunt motor.
6. Demonstrate use of NO/NC contacts in control circuit of different input, output devices.

Reference Books:

Sr. No.	Author	Title	Publication
01	S.K. Bhattachrya, Brijinder Singh	Control of Electrical Machines	New Age International Publishers.
02	U. S. Eswar	Electrical Motor Control Systems	TMH, New Delhi
03	Kenneth B. Rexford	Electrical Control for Machines.	Delmar Pub. Inc.

5E413 Digital Techniques (DTC)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement:
Students should develop following competencies:

1. Conversion & use of different number systems.
2. Simplify logic circuits using gates.
3. Understand applications of different digital circuits like counters, shift registers etc.

Rationale:
This subject helps the students in learning concepts and principles of digital techniques & its applications so that they acquire logic circuit designing skill. It will be useful for solving problems in technology areas like microprocessor, control system and circuit design.

Objectives:
Students should be able to
- Convert one number systems into other as per requirements.
- Develop & simplify logic circuits using different IC's.
- Know different applications of Digital circuits such as Flip-flops, Counters
- Shift registers etc.
- Know pin configuration of different IC's.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Number Systems and Binary Codes** 1.1 Introduction to digital Systems 1.2 Number Systems 1.2.1 Binary number system 1.2.2 Decimal number system 1.2.3 Octal number system 1.2.4 Hexadecimal number system 1.3 Conversion of numbers 1.3.1 Binary codes to BCD numbers 1.3.2 BCD to binary conversion & vice- versa using IC 74184 and IC 74185	11	14

02	**Logic Gates** 2.1 Basic Logic Gates: NOT, AND, OR –Their symbols, Truth tables, logic equations and applications. 2.2 Universal logic gates –NOR & NAND gates, symbols and truth table 2.3 Basic logic gates using universal gates 2.4 Exclusive OR gate 2.5 Exclusive NOR gate 2.6 De Morgan's theorem 2.7 Numerical based on 2.1 to 2.6 2.8 K- map reduction techniques	12	16
03	**Logic Families and Flip-flop** 3.1 Characteristics of IC logic gates 3.2 IC logic families, TTL, ECL &CMOS logic families. 3.3 Comparison of logic family, performance, advantages and disadvantage of IC logic families. 3.4 Pin diagram of 7400 TTL series/ CD 4000 series. 3.5 Flip flop 3.5.1 RS flip flop using NOR & NAND gates 3.5.2 clocked RS Flip flop 3.5.3 Propagation delay & Race around condition 3.5.4 Master slave (MS) JK Flip-flop 3.5.5 T Flip-flops 3.5.6 D type Flip-flops 3.5.7 Study of Flip flop IC's– 7476	11	14
04	**Counters and Shift Registers** 4.1 Introduction, Definition, types of Shift registers (SISO, SIPO, PISO, PIPO) 4.2 Working, Truth table & timing diagram of above Types of shift register. 4.3 Introduction of counter 4.3.1 Asynchronous counter, up, down & up-down counter 4.3.2 synchronous - up & down 4.3.3 MOD-N Counter design using Asynchronous counter. 4.3.4 Decade (BCD) counter IC 7490. 4.3.5 Applications of counters 4.3.6 Comparison between Asynchronous and Synchronous counter. 4.4 Comparison between Counters & Registers	12	16

05	**Multiplexer and De-multiplexer** 5.1 Necessity of Multiplexer and De-multiplexer 5.2 Principle of multiplexing and De-multiplexing 5.3 Types of multiplexer 2:1,4:1,8:1 & 16:1, their block diagrams and applications 5.4 Types of De-multiplexer 1:2,1:4,1:8 and1:16, their block diagrams and applications 5.5 Pin diagram of IC 74150, 74151, 74138 & 74139.	09	10
06	**Digital Measurement** 6.1 Concept of Adder and Subtractor 6.2 Analogy to Digital converter 6.3 Digital to analog converter 6.4 Digital Voltmeter- Ramp type DVM, Integrating type DVM its block diagram and operation 6.5 Digital Multimeter its block diagram and operation	09	10

List of Experiments (Any Ten)

1. Study & application of any one converter IC.
2. Verification of logic gates.
3. Verification of basic logic gates using NAND gates.
4. Verification of basic logic gates using NOR gates.
5. Verification of De Morgan's theorem.
6. Study of R-S flip-flop using NAND/NOR gates.
7. Study of M-S J-K flip-flop using NAND gates.
8. Study of SISO shift registers IC.
9. Study of 4-bit ripple counter using IC 7476.
10. Study of 3 bit synchronous counter.
11. Study of any one multiplexer & demultiplexer IC.

Reference Books:

Sr. No	Author	Title	Publication
1	R.P.Jain	Modern Digital Electronics	TMH
2	Willam H. Gathmann	Digital Electronics	Prentice Hall
3	K.S. Jamwal	Digital Electronics	Dhanpatrai

5E414 Linear Integrated Circuit (LIC)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge about integrated circuits
- Knowledge about various amplifiers
- Knowledge about timer circuits

Rationale:

The course aims to prepare the students to carry out the responsibilities related to electronics control systems. A diploma holder employed in industry needs to operate, tests and maintain electronics circuitry. Linear Integrated circuits have already found an important place in electronics circuit like Amplifiers, comparators and timers.

Course objectives:

Students should be able to

- Describe construction, working and application of Linear Integrated circuits.
- Realize importance of Linear Integrated circuits in electronic systems.
- Understand and design amplifiers and timers.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Fundamentals of op-amp** 1.1 Basic block diagram of op-amp, symbol 1.2 Ideal op-amp, important definitions of op-amp 1.3 Specifications , pin identification of 741 op-amp 1.4 Input offset voltage, Input offset current, Input bias current, output voltage adjustment range, input voltage range 1.5 CMRR, SVRR, Voltage gain, output voltage swing, slew rate 1.6 Temperature range, equivalent circuit, ideal voltage transfer curve of 741 op-amp.	12	15
02	**Basic op-amp Circuits** 2.1 Open loop op-amp configurations 2.2 Types of feedback, Inverting and non-Inverting amplifier with feedback, derivation of gain. 2.3 Input resistance, output resistance, bandwidth, total output offset voltage, virtual ground concept, voltage follower, differential amplifier using one op-amp.	12	15

03	**Special op-amp Circuits** 3.1 Current- to –voltage converter, V-to-I converter (floating load & grounded load) 3.2 Diode match finder, zener diode tester 3.3 Summing & averaging amplifier 3.4 Subtractor, Integrator, Differentiator	12	15
04	**Comparator** 4.1 Basic comparators, Zero- crossing detector 4.2 Schmitt trigger, voltage detector, peak detector 4.3 Half and full wave rectifiers.	09	10
05	**Active Filters** 5.1 Types of active filter and frequency response 5.2 First order low pass Butterworth filter 5.3 Second order low pass 5.4 Butterworth filter (derivation) 5.5 Band pass filter 5.6 Band reject filter 5.7 All pass filter	10	15
06	**555 Timer** 6.1 555 block diagram 6.2 555working as a monostable, bistable and astable multivibrator.	09	10

List of Experiments (Any eight)

1. To identify IC741 terminals and test op-amp
2. To perform inverting amplifier using IC741
3. To perform Non-inverting amplifier using IC741
4. To perform summing amplifier
5. To perform Zero crossing detector.
6. To perform Schmitt trigger circuit.
7. To perform half wave rectifier using op-amp
8. To perform Integrator circuit
9. To perform differentiator circuit
10. To perform monostable multivibrator using IC555
11. To perform bistable multivibrator using IC555
12. To perform astable multivibrator using IC555
13. To perform first order Butterworth filter

Reference Books:

Sr.No	Author	Title	Publisher
1	Ramankant Gayakawad	Op-amps & linear Integrated circuits	Prentice Hall of India Pvt.Ltd. New Delhi
2	U.A.Bakshi	Linear Integrated circuits	Technical publ. Pune
3	K.R.Botkar	Integrated circuits	Khanna publishers
4	D.Roy Chaudhury	Linear Integrated circuits	Newage international Ltd

5E415 Design of Control Panel (DCP)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):
- Ability to select fuses of various capacities according to type of loads
- Ability to select various contactors and MCBs and their testing
- Ability to design the control panel

Rationale:
Knowledge of fuses, contactors, MCB and design of control panel is essential. The knowledge of this course help students, while they will working in various organization. The students can go for self-employment. Hence utility of the course is very high.

Course objectives:
Student should be able to,
- Test the MCB and contactor
- Understand the design procedure of control panel
- Perform all types of domestic and industrial wiring

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Graphic Symbols for Electrical Circuits** 1.1 Drawing of various graphic symbols	02	02
02	**Development of Control Circuit:** 2.1 Development of simple control circuit diagrams 2.2 Development of motor control circuit diagrams 2.3 Circuit Analysis 2.4 Control circuit reading and interpretation.	08	09
03	**Commonly used Circuit Elements** 3.1 Fuses, Overload protection devices, contactor, Limit switches, Timers, Rotary Switches, Control transformers, Connectors, Braking systems for AC electric automatic machine tools.	12	15
04	**Standards** 4.1 Colour codes for push buttons 4.2 Control cabinet construction 4.3 Rigidity and enclosure material 4.4 Dimensions of control cabinets, and preferred heights for Location displays, controls, electrical devices, Overall control panel dimensions	10	13

05	**Panel Wiring** 5.1 Guidelines for machine wiring and panel wiring 5.2 Cable identification, designation of cable, cable numbering, Cable selection, Methods of wiring.	10	13
06	**Selection of Switchgear and oher Material** 6.1 Selection of contactor, Thermal Overload relay, Air circuit breaker, MCCB,MCB, Fuses, Timers, Panel meters, MPCB(DC) 6.2 Use of standard tables and charts is essential	12	15
07	**Installation and Testing** 7.1 Testing of Control Panel, Installation of panel board 7.2 Trouble shooting, maintenance and repairs of panel boards and accessories.	10	13

List of Practicals/Experiments:

Drawing sheets on-

1) Simple control circuit
2) Motor control circuit
3) Selection of type and capacity of fuse for given type of load and its testing
4) Selection of contactor and its testing
5) Case study/ Assignment on Control Panel Design
6) Visit of control Panel Manufacturing unit to study testing of control panel

Reference books :

Author	Title	Publisher
S.K.Bhattachrya Brijinder Singh	Control of Electrical Machines	New Age International Publishers
U S Eswar	Electrical Motor Control Systems	TMH, New Delhi

5E416 ILLUMINATION ENGINEERING (ILE)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	25	--	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Ability of selection of proper illumination scheme.
- Able to design all types off illumination scheme.
- Able to select proper controlling devices.

Rationale:

Student should have knowledge of designing, controlling and installation of different Illumination scheme.

Course objectives:

Student should able to,

- Select proper illumination scheme.
- Design illumination scheme.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Review of Fundamentals of illuminations** 1.1 Basic illumination terminology 1.2 Laws of illumination, polar curves, photometry 1.3 Measurement of illumination 1.4 Review of lamps & their comparisons 1.5 Standards for illumination	06	05
02	**Lamps** 2.1 Arc lamps: HID lamps, Metal halide, compact source metal hailed lamp. Xenon arc lamp, Arc lamp, classification. 2.2 Special purpose lamps : Flat lamps, Neon lamps & sign, LED lamps, Lasers, ultra violet, infra-red lamps, flash tubes, Electroluminescent lamps.	10	15
03	**Lighting Components** 3.1 Transformer for lighting 3.2 Ballast for fluorescent lamp 3.3 Ballast for HID & arc lamps 3.4 Igniters & starters 3.5 Lighting control by transformer and ballasts 3.6 Power factor correction of lamps 3.7 Electronic ballast for Fluorescent, HID & arc lamps. 3.8 Dimmer control	08	10

04	**Lighting Control and Control System** 4.1 Dimmer, dimmer laws, and types of dimmer – (mechanical, resistance, reactance, transformer, and electronic dimmer) 4.2 Necessity of lighting control (Practical, energy management role)	08	10
05	**Lighting for Interior Applications** 5.1 Design technique, standards for home lighting, office lighting, meeting rooms, Conference room, auditorium, places of worship 5.2 Importance of lighting at work place, Museums, art galleries, Libraries, Visitor centers, exhibitions, shops & office. Hotels, Hospitals & institutions. Restaurants, bars, pubs. 5.3 Illumination signs	14	16
06	**Flood Lighting** 6.1 Introduction, Factory lighting, security lighting road lighting, Road tunnel lighting Flood lighting, Public lighting, Railway Platform lighting, lighting for advertising boards / Hoarding, stage lighting, sports lighting	09	12
07	**Lighting for Special Applications** 7.1 Lighting for agriculture & horticulture, lighting for health care center, automobile lighting (two wheelers & four wheelers) lighting for decorative purpose.	09	12

LIST OF PRACTICALS:

1) Measurement of illumination by luxmeter.
2) Collect & Study techo-commercial information of different lamps available in market (i.e. Lamp manufacture, technical specification, cost, wattage etc.)
3) Visit to lamps manufacturing industry or testing lamps.
4) Collect & study techo-commercial information of different luminaries (i.e .fixtures) available in market (i.e. Manufactures, technical specification, orientation, cost etc.)
5) Design any one electronic lighting control circuit for any one lamps (one circuit for 5 students)
6) Design standard lighting scheme for home/office/conference hall/workshop places/hotels/hospitals
7) Visit to any three lighting scheme listed in Expt.6
8) Design of standard lighting scheme for factory/security/road/road tunnel/flood lighting/platform/advertising boards/stage/sports(any three)
9) Study of lighting scheme of two wheeler OR four wheeler.

Book: Illuminating engineering- Kamalesh Roy- Laxmi publications

5E501 Electrification of Buildings (EOB)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	--	125
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge about electrical hazards & safety precautions
- Supervise effectively the electrification of buildings
- Design illumination schemes as per requirement

Rationale:

Latest buildings are equipped with various types of electrical equipments and machines other .After studying this course student can undertake installation, maintenance work of such utilities with appropriate safety measures.

Course objectives:

- To know about technologies of electrification
- To know about illumination schemes
- To know about safety precautions
- To supervise effectively the electrification of buildings

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Different Types of Installations** 1.1 Comparison of installation for residential and Industrial buildings for loads, types of wires, types of wiring systems 1.2 Study of different types of wiring components used in residential installation. 1.2.1 Switches 1.2.2 Fixtures 1.2.3 Lamp holders 1.2.4 Ceiling roses, 1.2.5 Socket outlets 1.2.6 Fuses and fuse holders. 1.3 Study of wiring components used in industrial installation. 1.3.1 Three phase energy meter 1.3.2 Switch fuse unit 1.3.3 Distribution box.	07	06

02	**Illumination** 2.1Definitions : Plane angle, solid angle, luminous flux luminous intensity, lumen, illumination, MHCP, MSCP, MHSCP, reduction factor, brightness, 2.2 Laws of illumination 2.2.1 Inverse square law 2.2.2 Cosine law 2.3 Design of lighting scheme 2.3.1 Space to height ratio, 2.3.2 Utilization factor 2.3.3 Depreciation factor 2.4 Calculation of total 2.4.1 Lumens required 2.4.2 Illumination required for various purposes 2.5 Lighting schemes 2.5.1 Direct 2.5.2 Semi direct 2.5.3 Semi indirect.	08	10
03	**Internal Wiring Systems and Lamp Circuit for Residential Buildings** 3.1 Fundamentals of wiring systems 3.2 Rules 3.3 Wiring Systems 3.3.1 Looping systems 3.3.2 Tree system 3.3.3 Ring system. 3.4 Lamp circuits 3.4.1 Simple circuits 3.4.2 Parallel circuits 3.4.3 Master switch circuits.	08	10
04	**Industrial Wiring** 4.1 Factors to be considered for planning and execution 4.1.1 Planning and co-ordination 4.1.2 Independent substation 4.1.3 Selection of voltage 4.1.4 Switch boards 4.1.5 Lighting circuits 4.2 Load shedding 4.3 P.f. improvement 4.4 Systems of wiring 4.4.1 Main connections 4.4.2 Wiring of sub mains and sub circuits.	08	10
05	**Tariff** 5.1 Types of tariff 5.2 Calculation of energy cost.	04	08

06	**Pumps** 6.1 Types of pumps 6.1.1 Centrifugal 6.1.2 Rotary. 6.2 Characteristics of pumps 6.3 Factors to be considered for selection of pumps 6.4 Application of pumps 6.4.1 Residential 6.4.2 Industrial buildings 6.4.3 Sewage 6.4.4 Sump services 6.5 Drives for pumps 6.5.1 Three phase squirrel cage induction motor 6.5.2 Characteristics 6.5.3 Starters used 6.6 Troubles for centrifugal pumps 6.6.1 Causes 6.6.2 Remedies 6.7 Automatic water level controller 6.7.1 Block diagram and working	08	10
07	**Elevators** 7.1 Selection and installation 7.1.1 Types of elevator 7.1.2 Size of car 7.1.3 Shape of car 7.1.4 Elevator speeds 7.2 Location of pent house 7.3 Elevator machines 7.3.1 Power transmission 7.3.2 Gears 7.3.3 Braking 7.4 Elevator motor 7.4.1 Types of motor 7.4.2 Characteristics 7.5 Elevator control systems 7.5.1 Safety 7.5.2 Protective devices 7.6 Elevator maintenance.	12	16
08	**Electrical Safety** 8.1 Indian electricity rules for safety of person and equipment when working with electrical installation 8.2 General safety practices in electrical work 8.3 Earthing, 8.3.1 Necessity 8.3.2 Types 8.4 Electrical accidents	09	10

	8.4.1 Causes 8.4.2 Electric shock 8.4.3 Procedure for rescuing a person who has received an electrical shock 8.4.4 Electrical fire 8.4.5 Causes of fire 8.4.6 Precautions to avoid fire 8.4.7 Operation of fire extinguishers.		

LIST OF PRACTICAL

1. Study of different types of lamps.
2. Study of centrifugal pump.
3. Study of substation of the institute.

LIST OF SHEETS

1. Wiring components and symbols.
2. Types of wiring :- staircase wiring ,go down wiring ,hospital wiring.
3. Service connection and internal wiring.
4. Illumination case study-drawing and report such as laboratory, workshop, drawing hall hostel.

Reference books :

Sr no	Title	Author	publisher
1	Standard handbook for electrical engineers	D.G.Fink, H.W. Bealy	TMH
2	Pump selection and applications	Tyler Hicks	TMH
3	Industrial electrical system	Dale Patrick , Fardo	TMH
4	Electrical wiring estimating, costing	Uppal	Khanna
5	Electrical trade theory	M l Ghosh	TMH

5E502 Electrical Power System (EPS)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Supervise various operations of electrical power system.
- Knowledge of service organization structure & Role of electrical engineer in it.
- Numerical ability to solve problems.
- Adopts Electrical Safety practices.
- Use of software packages.
- Acquire supervisory skill & managerial skills in managing, men, material, machines & techniques of economy & quality.
- Communicate effectively by using different modes.

Rationale:

In the recent year "POWER SYSTEM" has assumed considerable importance because of tremendous increase in load. An electrical engineer working in a POWER SYSTEM must have complete knowledge of power system operation, Generation of electrical power at lowest possible cost and reliable supply is necessary in today's fast changing technology and globalizing economy.

Course objectives:

Student should be able to,

- Study different methods of power station control.
- Study economics loading of Power station.
- Solve different control problems of power system operation.
- Study modern trends in power station operation.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Per Unit Quantities** 1.1 Per unit quantities 1.2 Per unit system applied to single phase circuits 1.3 Per unit system extended to three phase circuits 1.4 Selection of base values 1.5 Changing the base of per unit quantities. 1.6 Per unit impedance of two winding transformer 1.7 Advantages and disadvantages of per unit system 1.8 Simple numerical based on per unit system.	09	12
02	**Load Flow Studies** 2.1 Need of load flow studies 2.2 Bus classification 2.3 Bus admittance matrix	09	12

	2.4 Formation of "Y" bus 2.5 Numericals for 3 bus system including bus reference		
03	**Power System Stability** 3.1 Introduction to system stability 3.2 Steady state stability and transient stability 3.3 Power angle diagram (Only introduction, no numericals)	07	08
04	**Economic Operation / Loading of Power Plant** 4.1 Methods of loading turbo generators 4.2 Criteria for optimum loading of power plant. 4.3 Incremental transmission loss 4.4 Hydro thermal coordination 4.5 Advantages of hydro thermal coordination	12	14
05	**Load Frequency and Voltage Control** 5.1 Necessity of maintaining constant frequency 5.2 Load frequency control- single area case (Turbine speed governing system) 5.3 Importance of voltage control 5.4 Methods of voltage control (only names) 5.5 Excitation control 5.5.1 Tirril regulator 5.5.2 Browen Boveri regulator 5.6 Tap changing transformer method 5.6.1 Off- Load tap changing method 5.6.2 On- Load tap changing method 5.7 Automatic voltage and frequency control of single area system	15	20
06	**Concept of Load Dispatch** 6.1 Interconnected systems – introduction, advantages and disadvantages 6.2 Functions of load dispatching center 6.3 SCADA system – configuration and functions 6.4 Load forecasting 6.4.1 Short range load forecasting 6.4.2 Medium range load forecasting 6.4.1 Long range load forecasting 6.5 Unit commitment 6.6 Load shedding and governing factors	12	14

Practical:

Skills to be developed:

Intellectual Skills:

1. Knowledge Recalling Skill
2. Identification Skill
3. Interpretation Skill
4. Planning Skill
5. Information Searching skill

Assignments:

01 Visit to Power Plant & Report Writing
• Draw schematic diagram & layout.
• Write different components of power plant & their functions.
• Describe different controls in operation of power plant like AGC/frequency control/voltage control.
• Study different disturbances in the station & how system can be restored.
• Study different types of stability.

02 Study of load dispatch station
• Study different components of LDS.
• Study and operation of SCADA.
• Study control of real & reactive power in LDS on monitor (online).
• Understand the effect of load shedding through single line diagram on monitor.
• Analyze the incentive & penalty for the change of frequency.

03 Load flow analysis (practical session for numerical)
• Take suitable examples on –
- Study of simple three bus system.
- Formation of Y- bus.
- SLFE equations.

04 Study Of Different Equipments Of Voltage Control
• Draw diagrams of equipments.
• Describe working of them.

05 Study different Tariffs & collect information about it & write a report on different Tariff structures.

06 Collect seminar papers on any topic related to subject given by experts in conferences or published in journals / magazines & write brief report on it.

Reference Books:

Author	Title	Publisher
I. J. Nagrath & D. P. Kothari	Power system Engineering	TMH
Vadhera	Power system analysis and stability	Khanna
C.L. Wadhwa	Power system	New Age
V.K. Mehta	Principles of power system	S.Chand

5E503 Energy Conservation and Audit (ECA)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	50	--	25	175
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge about energy conservation
- Develop a novel method of energy audit and conservation
- Awareness about present state of energy resources

Rationale:

The economic ability of a nation depends on its ability to produce and manage sufficient supplies of low cost ,safe energy. .Due to the rapid rate of industrialization and dwindling resources ,energy crisis has assumed huge magnitude. This subject will make the student aware about the present day scenario about energy crisis and methods to deal with the problem,

Course objectives:

- To know about technologies of energy utilization
- To know about energy crisis
- To know about energy conservation and energy management case studies.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Energy** 1.1 Review of various energy sources, 1.2 Need of energy conservation and energy audit.	06	10
02	**Energy Conservation** 2.1 Lighting energy: Methods/Techniques of efficient lighting. 2.2 Heating: Methods/Techniques of energy Saving in Furnaces, Ovens and Boilers. 2.3 Cooling: Methods/Techniques of Energy Saving in Ventilating systems and Air Conditioners 2.4 Motive power, Energy Efficient Motors, and Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters . 2.5 Power factor improvement devices and soft starters/Variable Frequency Drives. 2.6 Amorphous Core Transformers 2.7 Cogeneration -Types and Advantages	17	20

03	**Tariff and Energy Conservation in Industries** 3.1 Energy cost and Recent MSEB tariffs, 3.2 Application of Tariff System to reduce Energy bill, 3.3 Energy Conservation by improving load factor and power factor.	08	10
04	**Energy Conservation in Transmission and Distribution Systems** 4.1 Reactive power compensation, 4.2 Demand side management, 4.3 System voltage optimization and phase current balancing, 4.4 Losses in transmission and distribution system and its minimization	08	10
05	**Energy and the Environment** 5.1 Environment and social concerns related to energy utilization 5.2 The green house effect 5.3 Global Warming and its effect on Pollution, Acid rains 5.4 Global Energy and environment Management	08	10
06	**Energy Audit** 6.1 Procedure of Energy audit 6.2 ABC analysis 6.3 Energy Flow Diagram and its importance 6.4 Measurements in energy audit and various measuring instruments 6.5 Questionnaires for the energy audit 6.6 Internal energy audit checklist 6.7 Equipment used for energy conservation, Calculation of payback period for energy conservation equipment 6.8 IE rules and regulations for energy audit, Electricity act 2003	17	20

List of Practicals:

1. Energy saving by using electronic ballast as compared to conventional choke.
2. Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.
3. Make a survey of one of the establishment to identify different methods used for energy conservation.
4. Prepare Energy audit report for Industry/workshop/ Institute or its one section.
5. Searching the website of power ministry and MERC for Electricity act 2003 and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.

Reference books :

Sr. No.	Author	Title	Publication
01	Siemens	Power Factor Correction	New Age Vol.38 2005
02	T.Gonen	Electric Power Distribution System Engg.	Tata McGraw Hill
03	M.J. Steinburg and T.H. Smith	Economy Loading of Power plant and Electric system	John Willey and sons
04	C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy	New Age 2004

5E504 Non conventional Energy Resources (NCR)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Understand different non conventional energy resources & generation of electricity from them.
- Understand the detailed working of these methods of generation.

Rationale:

As the natural sources of energy are going to exhaust in nature, renewable sources of energy has got prime importance. Now a days, the development of nation is counted in terms of per head energy consumption & so the generation & use of energy has got prime importance.

Course objectives:

Students should be able to-

- Know the importance of non conventional energy sources.
- Know the technique of power generation from renewable sources.
- Know the economics of power generation with the combination of conventional & non conventional energy sources.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**General Introduction to Renewal Energy sources** 1.1 Renewable energy sources, 1.2 Types of Renewable energy sources. 1.3 Advantages and disadvantages of renewable energy sources 1.4 Future Prospects of renewable energy sources	04	06
02	**Solar Energy and Solar Photovoltaic System** 2.1 Solar Radiation. 2.2 Solar Energy collector. 2.2.1 Flat plate collector. 2.2.2 Flat plate collector with honey comb structure. 2.2.3 Concentrating collector. 2.2.4 Solar ponds. 2.3 Solar power tower. 2.4 Solar Energy storage. 2.4.1 Electrical storage (Battery storage) 2.4.2 Mechanical storage (Pumped Hydroelectric ,Compressed air, fly wheel) 2.5 Advantages and disadvantages of solar energy	16	20

	2.6 Photovoltaic cell 2.7 Photovoltaic power generation (block diagram) 2.8 Types of Photovoltaic power generation systems 2.8.1 Stand alone PV power generation systems 2.8.2 Hybrid systems. 2.8.3 Grid connected systems 2.8.4 Consumer application		
03	**Wind Energy** 3.1 Introduction 3.2 Historical development of wind power. 3.3 Block diagram of a wind electric system 3.4 Types of wind turbine (Horizontal axis & Vertical axis) 3.5 Variation of power out put with wind speed. 3.6 Selection of site for WTGS 3.7 Economic size of wind turbine generator (WTG) 3.8 Advantages and disadvantages of Wind energy. 3.9 Modes of wind power generation (Stand alone, Back up, Grid connected)	12	14
04	**Geothermal Energy** 4.1 Introduction. 4.2 Earth's energy. 4.3 Types of Geothermal resources (only list) (Hydro thermal, Vapour Domained, Hot Dry rock, Geo pressure, Magma) 4.4 Heat extraction from earth. 4.5 Vapour turbine cycle. 4.6 Advantages and disadvantages of Geo thermal Energy. 4.7 Geothermal energy in India – Prospects	08	10
05	**Ocean Energy** 5.1 Introduction to Ocean thermal energy. 5.2 Ocean thermal energy. 5.3 Open cycle OTEC System. 5.4 Closed cycle OTEC System. 5.5 Advantages and disadvantages of Ocean thermal energy. 5.6 Introduction to tidal energy. 5.7 Basic principle of tidal energy. 5.8 Operation methods of Utilization of tidal energy. (Single basin & double basin arrangements) 5.9 Site requirements for tidal power generation. 5.10 Advantages and disadvantages of tidal power generation.	10	12

06	**Energy from Biomass** 6.1 Introduction to Biomass. 6.2 Biomass resources. 6.3 Biogas generation. 6.4 Biogas plant. 6.4.1 Floating drum type biogas plant. 6.4.2 Fixed dome type biogas plant. 6.5 Advantages and disadvantages of Biomass energy.	08	10
07	**Other Energy Sources** 7.1 Principle of operation of fuel cell. 7.2 Hydrogen Oxygen cell (Hydrox cell) 7.3 Advantages and disadvantages of Fuel cells. 7.4 Principle of MHD power generation. 7.5 Advantages and disadvantages of MHD power Generation.	06	08

Experiments:

1) Study of solar energy & solar photovoltaic systems through books, literatures & Internet.
2) Study of wind energy systems through books, literatures & Internet.
3) Study of Geo thermal energy systems through books, literatures & Internet.
4) Study of Ocean energy through books, literatures & Internet.
5) Study of Biomass energy through books, literatures & Internet.
6) Study of Fuel cells through books, literatures & Internet.
7) Minimum two visits on any of the above generating stations and visit report on it.

Reference books :

Sr. No.	Author	Title	Publisher
1	G.D. Rai	Non conventional energy sources	Khanna publishers
2	B.R.Gupta	Generation of electrical energy	S. Chand & com. ltd
3	D.P. Kothari	Renewable energy sources and emerging technologies	PHI Learning

5E505 High Voltage Engineering (HVE)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Ability to select various generators used for generating high D.C. voltages
- Ability to select various equipments used for generating high alternating and impulse voltages.
- Ability to test the electrical apparatus by high D.C. voltages, high alternating, and impulse voltages.
- Ability to perform routine/type tests and destruction type tests on different electrical apparatus for testing.

Rationale:

Electrical energy is the most widely used form of energy; High voltage engineering makes the students able to work in industry of high voltage equipments like circuit breakers, transformers, insulators etc and also in electrical supply companies; This course makes the student aware with the modern trends and technology and fulfill the diversified interests of the students.

Course objectives:

- Students should be able to know different type of methods for generating high voltages.
- Students should be able to test electrical apparatus by high A .C., D.C., and impulse voltages.
- Students should understand breakdown mechanism of different dielectrics.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Introduction** 1.1 Electric field stresses 1.2 Gas/Vacuum as insulator. 1.3 Liquid breakdown 1.4 Solid breakdown. 1.5 Surge voltages & their distribution with control	04	06
02	**Conduction and Breakdown in Gases, Liquids and Solids** 2.1 Ionization processes. 2.1.1 Ionization by collision. 2.1.2 Photo Ionization. 2.1.2 Secondary Ionization processes.	22	25

	2.2 Townsends current growth equation. 2.3 Current growth in the presence of the secondary Processes. 2.4 Townsends criteria for breakdown. 2.5 Streamer theory of breakdown in gases. 2.6 Conduction and breakdown in pure liquids. 2.7 Conduction and breakdown in commercial liquids. 2.7.1 Suspended particle theory. 2.7.2 Cavitation & bubble theory. 2.8 Breakdowns in Solid dielectrics in practice. 2.8.1Chemical & electrochemical deterioration & Breakdown. 2.8.2 Breakdown due to treeing & tracking. 2.8.3 Breakdown due to internal discharges		
03	**Generation of High Voltages** 3.1 Necessity of generation of high voltages. 3.2 Generation of high D.C. voltages. 3.2.1 Half & full wave rectifier circuits. 3.2.2 Voltage doublers circuit. 3.2.3 Cockcroft-Walton voltage multiplier circuit. 3.3 Generation of high A.C. voltages. 3.3.1 Cascade transformers. 3.3.2 Resonant transformers. 3.4 Generation & Necessity of impulse voltages , standard impulse wave shape. 3.5 Multistage impulse generator – Marx circuit.	22	25
04	**Measurement of high voltages** 4.1 Measurement of high d.c. voltages. 4.1.1 Resistance potential divider. 4.1.2 Electrostatic voltmeter. 4.1.3 Generating voltmeter. 4.2 Measurement of high a.c. voltages. 4.2.1 Capacitive voltage transformer. 4.2.2 Peak voltage measurement with sphere gaps.	08	12
05	**High Voltage Testing of Electrical Apparatus** 5.1 Testing of insulators. 5.1.1 Definitions: Disruptive discharge voltage, Withstand voltage, 50 % flyover voltage, 100% flyover voltage, Creepage voltage, A.C. test voltage, Impulse voltage.	08	12

	5.1.2 Tests on insulator – power frequency test, Impulse test. 5.2 Testing of transformers 5.2.1 Partial discharge test 5.2.2 Impulse test.		

List of practical (All compulsory)

1. Study of Ionization processes.
2. Study of conduction & break down in gases.
3. Study of conduction & break down in liquid dielectric.
4. Study of conduction & break down in solid dielectric.
5. Study of H.V. d.c. generator.
6. Study of H.V. a.c. generator.
7. Study of Electrostatic voltmeter.
8. Study of measurements with sphere gap
9. Testing of insulators.
10. Testing of transformers.

Reference/Text Books:

Sr. No.	Author	Title	Publisher
1	Naidu, Kamaraju	High Voltage Engineering	TMH
2	C.L.Wadhawa	High Voltage Engineering	New age
3	Subir Ray	An introduction to High Voltage Engineering	PHI Learning

5E506 Programming in C (CPR)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Able to apply technology of computer science to electrical field.
- Knowledge to solve problems using 'C'.

Rationale:

As a diploma engineer, it is necessary to know more about computer operation. In order to work in software engineering domain, course which describes different programming methodologies and languages of computers is must.

Course objectives:

Students should be able to

- Use and work in programming environment.
- Interpret 'C' Programs.
- Solve the problems using 'C'.
- Implementing 'C' functions.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Steps in Program Development** 1.1 Programming Process 1.2 Algorithm 1.3 Flowchart & different Symbols.	06	07
02	**Study of C as a Programming Language** 2.1 History of C, 2.2 Introduction to C, 2.3 Sample C program 2.4 Basic structure of C program 2.5 Execution of C program.	03	08
03	**Constants, Variables and Data types** 3.1 Character set 3.2 Keywords & identifiers 3.3 Constants 3.4 Data types 3.5 Variables 3.6 Declaration of variables	06	12

04	**Operators and Expressions** 4.1 Arithmetic operators 4.2 Relational operators 4.3 Logical operators 4.4 Assignment operators 4.5 Increment & decrement operators 4.6 Conditional operators 4.7 Bit-wise operators 4.8 Special operators 4.9 Arithmetic expressions 4.10 Evaluation of expressions 4.11 Type conversions in expressions	07	08
05	**Managing Input and Output Operators** 5.1 Reading a character 5.2 Writing a character 5.3 Formatted input 5.4 Formatted output.	03	08
06	**Decision Making Branching and Looping** 6.1 Decision making with IF statement 6.2 Simple IF statement 6.3 The IF ELSE Statement 6.4 The nesting of IF statement 6.5 The ELSE IF ladder 6.6 The SWITCH statement 6.7 The GOTO statement 6.8 The WHILE statement 6.9 The DO statement 6.10 The FOR statement	10	10
07	**Functions** 7.1 User defined functions 7.2 A multifunction program 7.3 The form of c function 7.4 Return value and their types 7.5 Calling a function 7.6 Category of functions 7.7 No arguments and no return value 7.8 Arguments with return value 7.9 Nesting of Function 7.10 Recursion	10	09
08	**Arrays** 8.1 One-dimensional arrays 8.2 Two-dimensional arrays 8.3 Multi-dimensional arrays	10	10
09	**Strings** 9.1 Declaring and initializing string variables 9.2 Reading strings from terminal	09	08

	9.3 Writing strings to screen 9.4 Comparison of two strings 9.5 String handling functions0 9.6 Table of strings.		

Practical :.

List of Practical:

1. Demonstration of Turbo-C Compiler, Creating a program, Compiling and linking, Executing programs
2. Write 'C' programs based on declaring variables and assigning values to variables
3. Write at least 5 programs based on expressions and operators.
4. Programs using scanf( ), printf( ), getch( ), putch( ).
5. Programs using following control statements:
   If statements, Switch statements, Goto statements
6. Programs using following loop controls:
   While loop, Do while loop, For loop
7. Write a Program using Function
8. Write program based on arrays
9. Write programs using strings operations such as comparison, concatenation, copying, count and append.

TEXT BOOK:

Sr. No	Title	Author	Publisher
1	Let us 'C'	Yashwant Kanitkar	BPB publications
2	Programming in 'C'	Balguruswamy	Tata Mc- Graw Hill
3	'C' for engineers	Prakash khanale, Madhuri Joshi	-
4	Introduction to 'C' programming	Denis Ritchie and Kerninghan	Prantice Hall Publications
5	Introduction to 'C' programming	Byron Gotfried	Tata McGraw Hill

5E507 Microprocessor and Applications (MPA)

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- To understand the structure of microprocessor system
- To be familiar to assembly language programs
- Use of microprocessor for interfacing I/O devices
- Use of microprocessor in different electrical applications

Rationale:

The course is to prepare the engineers to carry out the responsibilities related to Industrial automation. A diploma holder needs to have basic knowledge of programming for industrial process control

Course objectives:

Students should be able to

- Develops the assembly language programs
- Interface microprocessor to I/O devices
- Use of microprocessor systems for different Electrical application

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Introduction to Microprocessor** 1.1 Evolution of Microprocessors 1.2 Organization of microcomputers 1.3 Minicomputers, Mainframe and upper computer.	05	06
02	**Semiconductor Memory System:** 2.1 Introduction to Semiconductor memories 2.2 RAM, ROM, PROM, EPROM, EEPROM 2.3 Dynamic RAM.	04	05
03	**Architecture of 8085 Microprocessor** 3.1 Block diagram of 8085 3.2 Pin diagram of 8085 3.3 Functions of different pins and different blocks.	05	06
04	**Instructions of 8085** 4.1 Instruction set of 8085 4.2 Classification of instructions	13	15

	4.2.1 Data transfer group 4.2.2 Arithmetic group 4.2.3 Logical group 4.2.4 Branch group 4.2.5 I/O group 4.2.6 Machine control group 4.3 Sample timing diagram of data transfer instruction 4.4 Addressing modes 4.6.1 Direct addressing 4.6.2 Register addressing 4.6.3 Register indirect addressing 4.6.4 Immediate addressing 4.6.5 Implicit addressing		
05	**Programming of 8085** 5.1 Assembly language programs based on 5.1.1 Arithmetic 5.1.2 Logic 5.1.3 Branch 5.1.4 Machine control group of instructions 5.2 Programs for counting time delays using stacks and subroutines call and return instructions.	13	15
06	**Interrupts of 8085** 6.1 Methods of data transfer 6.1.1 Serial data transfer 6.1.2 Parallel data transfer 6.1.3 Interrupt driven data transfer 6.2 Interrupt structure of 8085.	09	13
07	**Interfacing of Peripheral Devices to 8085** 7.1 8255 PPI 7.1.1Block diagram of 8255 7.1.2 study of mode0 7.1.3 mode1 7.1.4 mode2 7.1.5 BSR mode 7.2 Interfacing and Input output programs in mode0 and BSR mode 7.3 Use of 8255 for stepper motor control and relay control. 7.4 8253 PIT 7.4.1 Block diagram 7.4.2 Interfacing with 8085 7.4.3 Study of mode0	08	12

	7.4.4 Mode1 7.4.5 Mode 2 7.4.6 Mode 3 7.4.7 Mode 4 7.4.8 Mode 5.		
08	**Programmable Logic Controllers** 8.1 Introduction to PLC 8.2 Architecture of PLC 8.3 Role of PLC in automation 8.4 PLC Fundamentals: Block diagram of PLC 8.5 Study of PLC components 8.5.1 Power supply 8.5.2 CPU 8.5.3 I/O modules 8.6 Types of inputs and outputs 8.7 Concept of flags 8.8 Ladder diagrams.	07	08

LIST OF EXPERIMENTS (Any eight)

1. Study of microprocessor kit
2. Execution of programs for data transfer
3. Execution of arithmetic programs a). 8-bit addition b). 8-bit subtraction
4. Program for 16-bit addition
5. Program for 16-bit subtraction
6. Program for arranging numbers in ascending orders
7. Program for arranging numbers in descending orders
8. Program for multiplication of 8-bit data
9. Program for division of 8-bit data
10. Program to output data using 8255 in mode 0
11. Program to input data using 8255 in mode 0
12. Program on BSR bit set reset mode of 8255
13. Program for rotation of stepper motor

Reference books :

Sr. No	Author	Title	Publisher
1	B. Ram	Microprocessor and Microcomputer	
2	R. S. Gaonkar	Microprocessor Architecture, programming and applications	Weley estern Limited
3	U.A.Bashi & A.P.Godse	Microprocessor-I	Technical Publications pune
4	Sontakke & kulkarni	Microprocessor 8085 & Architecture	

5E508 Thyristorised Control Drives (TCD)

Teaching scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
Total credits	06	Duration (Hrs.)	01	03	--	--	--	--

Competency statement(s):

- Knowledge of various types of drives
- Selections of drives for applications

Rationale:

The course aims to prepare the Engineer to carry out the responsibilities related to Electrical motor drives using power semiconductor devices. A diploma holder employed in industry needs to operate, tests and maintain industrial motor controls.

Course objectives:

Students should be able to

- Describe speed control techniques of different motors.
- Describe construction, working and application of converter, invertors, and chopper for motor control
- Understand power electronic control of drives.

Contents: Theory

Chapter	Name of the Topic	Hrs	Marks
01	**Introduction of Electrical Drives.** 1.1.Block diagram of electrical drives 1.2 Parts of electrical drives 1.3 Basic torque equation and multi-quadrant operation.	09	10
02	**Selection of Motors for Drives.** 2.1 Criterion for selection of motor for particular applications 2.2 Selection of motors for locomotive, Compressor, paper mill.	09	10
03	**D.C Motor Drives.** 3.1 Review of D.C motors 3.2 Principle of D.C motor control 3.3 Armature voltage control, and flux control 3.4 Four-quadrant operation 3.5 Single phase controlled converter 3.6 Separately excited dc motor drive 3.7 Converter configuration for a four quadrant D.C motor drive	16	22

04	**Chopper Controlled D.C Drives.** 4.1 Principle of operation of the chopper 4.2 Chopper controlled dc separately excited and series motor drives	08	10
05	**Induction Motor Drives** 5.1 Review of Induction motors and performance characteristics 5.2 Speed control methods (Stator side) 5.3 Stator voltage control using voltage source inverter	22	28

LIST OF EXPERIMENTS (Any Eight)

1. Speed control of D.C motor using single phase fully controlled converter
2. Speed control of D.C motor using single phase half controlled converter
3. Speed control of D.C motor using chopper
4. Speed control of Single phase Induction motor using A.C voltage regulator
5. Speed control of Three phase Induction motor using voltage source Inverter.
6. Study of voltage/ frequency control of Induction motor
7. Study of locomotive drives.
8. Study of different drives components
9. Study of PWM voltage source inverter.
10. Study of Electrical drives for domestic applications.

Reference books :

Sr. No	Author	Title	Publisher
1	G.K Dubey	Fundamentals of Electrical Drives	II Edition, Narosa Publishing House, New Delhi
2	M.H. Rashid	Power Electronics	II Edition, Pearson Education Pvt.Ltd.
3	Kanchandani	Power Electronics	Tata-McGraw Hill Publications
4	P.S Bhimbra	Power Electronics	Khanna Publishers Delhi