Final Version

REVISED CURRICULUM OF

ELECTRICAL ENGINEERING DIPLOMA PROGRAM

IN

MULTI POINT ENTRY & CREDIT SYSTEM

PART-II

For the State of Meghalaya

National Institute of Technical Teachers' Training & Research
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

June 2015

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C O N T E N T S

SCHEME OF STUDIES AND EVALUATION (MPECS) FOR DIPLOMA IN ELECTRICAL ENGINEERING

1. FOUNDATION COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment*		Sessional	Viva		
1	G101	Communication Skill-I		2	0	2	70	15	15	-	25	-	125	3
2	G102	Communication Skill-II	G101	2	0	2	70	15	15	-	25	-	125	3
3	G103	Mathematics-I		4	1	0	70	15	15	-	-	-	100	5
4	G104	Mathematics-II		4	1	0	70	15	15	-	-	-	100	5
5	G105	Applied Mathematics	G103 G104	3	1	0	70	15	15	-	-	-	100	4
6	G106	Physics -I		2	0	2	70	15	15	25	25	-	150	3
7	G107	Physics-II	G105	2	0	2	70	15	15	25	25	-	150	3
8	G108	Chemistry - I		2	0	2	70	15	15	25	25	-	150	3
9	G109	Chemistry - II	G107	2	0	2	70	15	15	25	25	-	150	3
TOTAL				**23**	**3**	**12**	**630**	**135**	**135**	**100**	**150**	**0**	**1150**	**32**

*** The marks for assignment (15) should include five (5) marks for attendance.**

2. HARD CORE COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
10	G201	Engineering Drawing-I		1	0	4	-	-	-	-	50	-	50	3
11	G202	Engineering Drawing-II	G201	1	0	4	-	-	-	-	50	-	50	3
12	G203	Workshop Practice-I		0	0	4	-	-	-	-	25	25	50	2
13	G204	Workshop Practice-II	G203	0	0	4	-	-	-	-	25	25	50	2
14	G205A	Introduction to Information Technology		2	0	3	50	0	0	25	50	-	125	4
	G205B	*Introduction to Computer Programming												
15	G206A	Engineering Mechanics		3	0	2	70	15	15	25	25	-	150	4
	G206B	*C-Programming	G205B	2	1	2								
TOTAL				**7/6**	**0/1**	**21**	**120**	**15**	**15**	**50**	**225**	**50**	**475**	**18**

*G205B & G206B for CSE only

3. SOFT CORE COURSES: ***(301 and 302 are compulsory, any two from the rest)***

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessio nal	Viva		
16	G301	Development of Life Skill-I		1	0	2	-	-	-	-	25	25	50	2
17	G302	Development of Life Skill-II		1	0	2	-	-	-	-	25	25	50	2
18 & 19	G303	Engineering Economics & Accountancy		3	0	0	70	15	15	-	-	-	100	3
	G304	Entrepreneurship Development		3	0	0	70	15	15	-	-	-	100	3
	G305	Principles of Management		3	0	0	70	15	15	-	-	-	100	3
	G306	Organizational Behaviour		3	0	0	70	15	15	-	-	-	100	3
	G307	Environmental Education		3	0	0	70	15	15	-	-	-	100	3
TOTAL				**8**	**0**	**4**	**140**	**30**	**30**	**-**	**50**	**50**	**300**	**10**

4. BASIC TECHNOLOGY COURSES FOR ELECTRICAL ENGINEERING

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
20	EE 401	Electrical Engineering Circuits & Materials		3	0	2	70	15	15	25	25	-	150	4
21	EE 402	Electrical Measurement & Measuring Instruments		3	0	2	70	15	15	25	25	-	150	4
22	EE 403	Electrical Machine I		3	0	2	70	15	15	25	25	-	150	4
23	EE 404	Electrical Machines II	EE403	3	0	2	70	15	15	25	25	-	150	4
24	EE 405	Electrical Power System I		3	0	0	70	15	15	-	-	-	100	3
25	EE 406	Electrical Power System II	EE405	3	0	0	70	15	15	-	-	-	100	3
26	EE 407	Electrical Engineering Drawing		0	0	6	-	-	-	-	50	-	50	3
27	EE 408	Electrical Engineering Workshop		0	0	4	-	-	-	-	50	-	50	2
28	EE 409	Electronic Devices & Circuits I		3	0	2	70	15	15	25	25	-	150	4
29	EE 410	Electronic Devices & Circuits II	EE409	3	0	2	70	15	15	25	25	-	150	4
30	EE 411	Heat Engine		3	0	0	70	15	15	-	-	-	100	3
TOTAL				**27**	**0**	**22**	**630**	**135**	**135**	**150**	**250**	**-**	**1300**	**38**

5. **APPLIED TECHNOLOGY COURSES FOR ELECTRICAL ENGINEERING**

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
31	EE 501	Power Electronics		3	0	2	70	15	15	25	25	-	150	4
32	EE 502	Electrical Estimating & Illumination Design		3	1	0	70	15	15	-	-	-	100	4
33	EE 503	Digital Electronics and Microprocessor I		3	0	2	70	15	15	25	25	-	150	4
34	EE 504	Digital Electronics and Microprocessor II	EE503	3	0	2	70	15	15	25	25	-	150	4
35	EE 505	Switch Gear & Protection		3	0	0	70	15	15	-	-	-	100	3
36	EE 506	Instrumentation & Control		3	0	2	70	15	15	25	25	-	150	4
37	EE 507	C Programming with Linux		3	0	2	70	15	15	-	50	-	150	4
38	EE 508	Testing & Maintenance of Electrical Machines/Equipments		1	0	6	-	-	-	-	100	25	125	4
39	EE 509	Professional Practices I		0	0	2	-	-	-	-	50		50	1
40	EE 510	Professional Practices II		0	0	2	-	-	-	-	50	-	50	1
41	EE 511	Professional Practices III		0	0	3	-	-	-	-	50	-	50	2
42	EE 512	Professional Practices IV		0	0	3	-	-	-	-	50	-	50	2
43	EE 513	Professional Practices V		0	0	6	-	-	-	-	50	-	50	3
44	EE 514	Projects		0	0	8	-	-	-	-	100	50	150	4
TOTAL				**22**	**1**	**40**	**490**	**105**	**105**	**100**	**600**	**75**	**1475**	**44**

6. ELECTIVE COURSES FOR ELECTRICAL ENGINEERING (Any TWO to be taken)

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assign ment		Sessional	Viva		
45 & 46	EE 601	Computer based Industrial Control		3	0	2	70	15	15	25	25	0	150	4
	EE 602	Utilization of Electrical Power		3	0	2	70	15	15	25	25	0	150	4
	EE 603	Power Plant Engg.		3	0	2	70	15	15	25	25	0	150	4
	EE 604	Non Conventional Sources of Energy		3	0	2	70	15	15	25	25	0	150	4
	EE 605	High Voltage Engg.		3	0	2	70	15	15	25	25	0	150	4
	EE 606	Repairing of Electrical Machines & Household Equipment		3	0	2	70	15	15	25	25	0	150	4
TOTAL OF TWO COURSES				**6**	**0**	**4**	**140**	**30**	**30**	**50**	**50**	**0**	**300**	**8**

SAMPLE PATH: TERM - I

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G101	Communication Skill-I		2	0	2	70	15	10	5	-	25	-	125	3
2	G103	Mathematics-I		4	1	0	70	15	10	5	-	-	-	100	5
3	G106	Physics - I		2	0	2	70	15	10	5	25	25	-	150	3
4	G108	Chemistry - I		2	0	2	70	15	10	5	25	25	-	150	3
5	G201	Engineering Drawing – I		1	0	4	-	-	-	-	-	50	-	50	3
6	G203	Workshop Practice - I		0	0	4	-	-	-	-	-	25	25	50	2
7	G205A	Introduction to Information Technology		2	0	3	50	0	0	0	25	50	-	125	4
TOTAL				**13**	**1**	**17**	**330**	**60**	**40**	**20**	**75**	**200**	**25**	**750**	**23**

SAMPLE PATH: TERM - II

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G102	Communication Skill-II	G101	2	0	2	70	15	10	5	-	25	-	125	3
2	G104	Mathematics-II	G103	4	1	0	70	15	10	5	-	-	-	100	5
3	G107	Physics - II	G106	2	0	2	70	15	10	5	25	25	-	150	3
4	G109	Chemistry - II	G108	2	0	2	70	15	10	5	25	25	-	150	3
5	G202	Engineering Drawing – I I	G201	1	0	4	-	-	-	-	-	50	-	50	3
6	G204	Workshop Practice - II	G203	0	0	4	-	-	-	-	-	25	25	50	2
7	G206A	Engineering Mechanics	G106 & G107	3	0	2	70	15	10	5	25	25	-	150	4
8	G301	Development of Life Skill-I		1	0	2	-	-	-	-	-	25	25	50	2
9	EE509	Professional Practices - I		0	0	2	-	-	-	-	-	50	-	50	1
TOTAL				**15**	**1**	**20**	**350**	**75**	**50**	**25**	**75**	**250**	**50**	**875**	**26**

SAMPLE PATH: TERM - III

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	EE401	Electrical Circuit & Materials		3	0	2	70	15	10	5	25	25	-	150	4
2	EE402	Electrical Measurement and Measuring Instrument		3	0	2	70	15	10	5	25	25	-	150	4
3	EE409	Electronic Devices and Circuit-I		3	0	2	70	15	10	5	25	25	-	150	4
4	EE507	C-programming with Linux		3	0	2	70	15	10	5	-	50	-	150	4
5	G105	Applied Mathematics	G103 & G104	3	1	0	70	15	10	5	-	-	-	100	4
6	G303	Engineering Economics and Accountancy		3	0	0	70	15	10	5	-	-	-	100	3
7	EE407	Electrical Engineering Drawing		0	0	6	-	-	-	-	-	50	-	50	3
8	EE510	Professional Practices - II		0	0	2	-	-	-	-	-	50	-	50	1
TOTAL				**18**	**1**	**16**	**420**	**90**	**60**	**30**	**75**	**225**	**-**	**900**	**27**

SAMPLE PATH: TERM - IV

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	EE403	Electrical Machine-I		3	0	2	70	15	10	5	25	25	-	150	4
2	EE405	Electrical Power System-I		3	0	0	70	15	10	5	-	-	-	100	3
3	EE410	Electronic Devices and Circuit-II	EE409	3	0	2	70	15	10	5	25	25	-	150	4
4	EE411	Heat Engine		3	0	0	70	15	10	5	-	-	-	100	3
5	EE502	Electrical estimating and Illumination Design		3	1	0	70	15	10	5	-	-	-	100	4
6	EE503	Digital electronics And Microprocessor-I		3	0	2	70	15	10	5	25	25	-	150	4
7	EE408	Electrical Engineering Workshop		0	0	4	-	-	-	-	-	50	-	50	2
8	G302	Development of Life Skill-II	G301	1	0	2	-	-	-	-	-	25	25	50	2
9	EE511	Professional Practices - III		0	0	3	-	-	-	-	-	50	-	50	2
TOTAL				**19**	**1**	**15**	**420**	**90**	**60**	**30**	**75**	**200**	**25**	**900**	**28**

SAMPLE PATH: TERM - V

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	EE404	Elect. Machine-II	EE403	3	0	2	70	15	10	5	25	25	-	150	4
2	EE406	Electrical Power System-II	EE405	3	0	0	70	15	10	5	-	-	-	100	3
3	G304	Entrepreneurship Development		3	0	0	70	15	10	5	-	-	-	100	3
4	EE604	Elective-I Nonconventional sources of energy		3	0	2	70	15	10	5	25	25	-	150	4
5	EE504	Digital electronics & Microprocessor-II	EE503	3	0	2	70	15	10	5	25	25	-	150	4
7	EE508	Testing & Maintenance of Electrical Machines/Equipments		1	0	6	-	-	-	-	-	100	25	125	4
8	EE512	Professional Practices – IV*		0	0	3	-	-	-	-	-	50	-	50	2
TOTAL				**16**	**0**	**15**	**350**	**75**	**50**	**25**	**75**	**225**	**25**	**825**	**24**

*This includes industrial visit

SAMPLE PATH: TERM - VI

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	EE501	Power Electronics		3	0	2	70	15	10	5	25	25	-	150	4
2	EE505	Switchgear & protection		3	0	0	70	15	10	5	-	-	-	100	3
3	EE506	Instrumentation & Control		3	0	2	70	15	10	5	25	25	-	150	4
4	EE602	Elective-II Utilization of Electrical power		3	0	2	70	15	10	5	25	25	-	150	4
7	EE514	Project		0	0	8	-	-	-	-	-	100	50	150	4
8	EE 513	Professional Practices – V*		0	0	6	-	-	-	-	-	50	-	50	3
TOTAL				**12**	**0**	**20**	**280**	**60**	**40**	**20**	**75**	**225**	**50**	**750**	**22**

*This includes seminar on project

FOUNDATION COURSES

Applied Mathematics (for Electrical and Electronics Engg)

L	T	P	*Curri. Ref. No.: G 105*
3	1	0	

Total Contact hrs.: 60
Theory: 60
Practical: 0
Pre requisite: G103, G104
Credit: 4

Total marks: 100

Theory:
End Term Exam: 70
P.A.: 30
Practical: Nil
End Term Exam: Nil
P.A : Nil

RATIONALE :

Mathematics is an important tool to solve wide variety of engineering problems. Most of the technological processes in industry are described effectively by using mathematical framework. Mathematics has played an important role in the development of mechanical, civil, aeronautical and chemical engineering through its contribution to mechanics of rigid bodies, hydrodynamics, aero-dynamics and heat transfer etc. It has become of great interest to electrical engineers through its application to information theory, design of digital computer etc.

AIM :

Through this syllabus we aim to give students a strong foundation in Matrix and Vector with their applications. We also aim to give detail idea of Numerical Integration, Numerical solution of Non-Linear Equation, Gauss Elimination method and Differential Equations with application problems.

DETAIL COURSE CONTENT

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total Marks.
1.0	1.1 Numerical Solution of Algebraic Equations. (i) Bisection Method. (ii) Regula-falsi Method / Method of false position. (iii)Newton-Raphson Method. (iv)Problems on the above methods.	7	10
	1.2 **Numerical solution of simultaneous linear algebraic equations** **Containing 2 and 3 unknowns.** (i) Gauss elimination method. (ii) Iterative method: Gauss Seidal & Jacobi's method.	7	10

2.0	**PARTIAL DIFFERENTIATION.** (i) Introduction to functions of two or more variables. (ii) Geometrical Interpretation of a Function of two variables. (iii) Partial Derivatives. (iv) Second Order Partial Derivative. (v) Homogeneous function. (v) Euler's Theorem. (v) Problems	8	10
3.0	Differential Equations (ordinary): (i) Introduction. (ii) Order and degree of a differential equation. (iii) Formation of Differential Equations. (iv) Solution of a Differential Equation. (v) Differential equation of the first order and first degree. (vi) Variables separable. (v) Homogeneous Differential Equations. (vi) Linear Differential Equations. vii) Equations reducible to linear form. (vii) Exact differential Equations. (viii) Equations reducible to the exact form. (ix) Linear Differential Equations of second order with constant coefficients. (x) Complete solution = Complementary Function + Particular Integral. (xi) Method of finding Particular Integral. (xii) Applications of differential equations to electrical circuit problems. (xiii) Problems related to other physical systems.	20	15
4.0	**LAPLACE TRANSFORM (LT):** (i) Piece-wise or Sectional Continuity. (ii) Functions of exponential order. (iii) Definition of Function & the Transform Concept. (iv) Definition and Notation of Laplace Transform. (v) Linearity property. (vi) First shifting Theorem (First Translation). (vii) Second shifting Theorem (Second Translation). (viii) Change of Scale Property. (ix) Laplace Transform of Derivatives. (x) Laplace Transform of Integral (xi) Solution of Problems using LT (xii) Solution of ordinary differential equation up to second order using LT.	7	10
5.0	**CONCEPT OF INVERSE LAPLACE TRANSFORM 7 ITS PROPERTIES** (i) Definition of Inverse Laplace Transform and Null Function.	6	10

	(ii) Linearity Property. (iii) First Shifting Property. (iv) Second Shifting Property. (v) Change of scale property. (vi) Inverse Laplace Transform of derivatives. (vii) Convolution Theorem. (viii) Problems. (ix) Solution of Differential Equations using Laplace Transform.		
6.0	**FOURIER SERIES.** (i) Periodic function. (ii) Trigonometric series. (iii) Fourier series and Fourier coefficients Theorem. (iv) Finite discontinuity, Even functions and Odd functions. (v) Change of Interval and Change of Period. (vi) Complex form of Fourier series, Half range series (vii) Parseval's Identity for Fourier series. (viii) Problems using furrier series.	5	5
		60	70

Reference Books.

(1) Integral Calculus by B. C. Das and B. N. Mukherjee.
(2) Diploma Engineering Mathematics (Volume-II) by B. K. Pal.
(3) Applied Mathematics-I by Dr. J. S. Bindra and K. S. Gill.
(4) Applied Mathematics-II by Dr. J. S. Bindra and K. S. Gill.
(5) Applied Mathematics-III by Dr. J. S. Bindra.
(6) Engineering Mathematics (Volume-I, Volume-II & Volume-III) By S.Arumugam, A. Thangapandi Issac and A.Somsundaram.

SOFT CORE COURSES

Development of Life Skill -I

L	*T*	*P*	***Curri. Ref. No.: G301***
1	*0*	*2*	

Total Contact hrs : 45 **Total marks: 50** Practical: 30
Theory: 15 *End Term Exam: 25*
Tutorial: 0 *P.A : 25*
Practical: 30
Credit : 2

RATIONALE :

- Conduct different session to improve students memory Power
- Conduct different session to improve time management skills
- Motivate student to face realistic problem with confidence and positive approach

AIM

- Develop reading skills
- Use techniques of acquisition of information from various sources
- Draw the notes from the text for better learning.
- Apply the techniques of enhancing the memory power.
- Develop assertive skills.
- Prepare report on industrial visit.
- Apply techniques of effective time management.
- Set the goal for personal development.
- Enhance creativity skills.
- Develop good habits to overcome stress.
- Face problems with confidence

DETAILED COURSE CONTENT

UNIT	TOPIC/SUB-TOPIC	TOTAL HRS.
Unit -1	**Importance of DLS** Introduction to subject, importance in present context , application	**01**
Unit -2	**Information Search** Information source –Primary, secondary, tertiary Print and non – print, documentary, Electronic Information center, Library, exhibition, Government Departments. Internet Information search – Process of searching, collection of data –questionnaire, taking Interview, observation method.	**02**
Unit – 3	**Written communication** Method of note taking Report writing – Concept, types and format.	**01**

Unit – 4 **Self Analysis**
Understanding self —
Attitude, aptitude, assertiveness, self esteem,
Confidence buildings. Concept of motivation. **02**

Unit – 5 **Self Development**
Stress Management –Concept, causes, effects and remedies to
Avoid / minimize stress.
Health Management – Importance, dietary guidelines and exercises.
Time management- Importance, Process of time planning, Urgent
Vs importance, Factors leading to time loss and ways to handle it,
Tips for effective time management.
Emotion-concept, Types, Controlling, Emotional intelligence,
Creativity-concept, Factors enhancing creativity
Goal setting-concept, Setting smart goal **06**

Unit – 6 **Study habits**
Ways to enhance memory and concentration.
Developing reading skill.
Organisation of knowledge,
Model and methods of learning. **03**

SUGGESTED LEARNING RESOURCES

Reference Books:

1. Personality Development & Soft Skills - B. K. Mitra, Oxford University Press
2. Basic Managerial Skills for All - E.H. Mc Grath , S.J., Prentice Hall of India Pvt Ltd
3. Body Language - Allen Pease, Sudha Publications Pvt. Ltd.
4. Creativity and problem solving - Lowe and Phil, Kogan Page (I) P Ltd
5. Decision making & Problem Solving - Adair, J, Orient Longman
6. Develop Your Assertiveness - Bishop , Sue, Kogan Page India
7. Time management - Chakravarty, Ajanta, Rupa and Company
8. Life Skills Activities for Secondary Students with Special Needs - Darlene Mannix, Kindle Edition

Internet Assistance:
1) http://www.mindtools.com
2) http://www.stress.org
3) http://www.ethics.com
4) http://www.coopcomm.org/workbook.htm
5) http://www.mapfornonprofits.org/
6) http://www.learningmeditition.com http://bbc.co.uk/learning/courses/
7) http://eqi.org/
8) http://www.abacon.com/commstudies/interpersonal/indisclosure.html
9) http://www.mapnp.org/library/ethics/ethxgde.htm
10) http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm

11) http://members.aol.com/nonverbal2/diction1.htm
12) http://www.thomasarmstron.com/multiple_intelligences.htm
13) http://snow.utoronto.ca/Learn2/modules.html
14) http://www.quickmba.com/strategy/swot/

Practical :

Suggested List of activities:

- Conduct Guest Lectures.
- Conduct Industrial visits.
- Conduct Seminar/Group Discussions.

Suggested List of Assignments/Tutorial :

The Term Work Will Consist Of Following Assignments.

1 Library search:-
Visit your Institute's Library and enlist the books available on the topic given by your teacher. Prepare a bibliography consisting name of the author, title of the book, publication and place of publication.

2 Enlist the magazines, periodicals and journals being available in your library. Select any one of them and write down its content. Choose a topic for presentation.

3 Attend a seminar or a guest lecture, listen it carefully and note down the important points and prepare a report of the same.

4 Visit to any one place like historical/office/farms/development sites etc. and gather information through observation, print resources and interviewing the people.

5 Prepare your individual time table for a week –
(a) List down your daily activities.
(b) Decide priorities to be given according to the urgency and importance of the activities.
(c) Find out your time wasters and mention the corrective measures.

6 Keep a diary for your individual indicating- planning of time, daily transactions, collection of good thoughts, important data, etc

7 Find out the causes of your stress that leads tension or frustration .Provide the ways to Avoid them or to reduce them.

8 Undergo the demonstration on yoga and meditation and practice it. Write your own iews, feeling and experiences on it.

NOTE: - THESE ARE THE **SUGGESTED ASSIGNMENT** FOR GUIDE LINES TO THE SUBJECT TEACHER. HOWEVER THE SUBJECT TEACHERS CAN SELECT, DESIGN ANY ASSIGNMENT RELEVANT TO THE TOPIC, KEEPING IN MIND THE OBJECTIVES OF THIS SUBJECT.

Development of Life Skill -II

L	*T*	*P*	***Curri. Ref. No.: G 302***
1	*0*	*2*	

Total Contact hrs : 45 **Total marks: 50** Practical:
Theory: 15 *End Term Exam: 25*
Tutorial: 0 *P.A : 25*
Practical: 30
Credit : 2

UNITS	Contents	Hours
Units1	**Inter personal Relation** Importance, Interpersonal conflicts, Resolution of conflicts, Developing effective interpersonal skills communication and conversational skills, Human Relation Skills (People Skills)	
Unit 2	**Problem Solving** **I) Steps in Problem Solving (Who? What? Where? When? Why? How? How much?)** 1. Identify, understand and clarify the problem 2. Information gathering related to problem 3. Evaluate the evidence 4. Consider feasible options and their implications 5. Choose and implement the best alternative 6. Review **II) Problem Solving Technique** 1. Trial and Error, 2. Brain Storming 3. Thinking outside the Box	
Unit 3	**Presentation Skills** Concept, Purpose of effective presentations, **Components of Effective Presentations:** Understanding the topic, selecting the right information, organizing the process interestingly, Good attractive beginning, Summarising and concluding, adding impact to the ending, **Use of audio visual aids** OHP, LCD projector, White board, **Non verbal communication:** Posture, Gestures ,Eye contact and facial expression, Voice and Language Volume, pitch, Inflection, Speed, Pause, Pronunciation, Articulation, Language Handling questions Respond, Answer, Check, Encourage, Return to presentation	

	Evaluating the presentation : Before the presentation, During the presentation, After the presentation	
Unit 4	**Looking for a Job** Identifying different sources announcing Job vacancies, Skim, scan and read advertisements in detail, write efficacious CVs, write covering letters to a company CVs, write Job Application Letters in response to advertisements and self-applications	5
Unit 5	**Job Interviews** ***Prepare for Interviews:*** Intelligently anticipating possible questions and framing appropriate answers, Do's and don'ts of an interview(both verbal and non verbal), **Group Discussion:** Use of Non verbal behavior in Group Discussion, Appropriate use of language in group interaction, Do's and don'ts for a successful Group Discussion	10
Unit 6.	**Non verbal graphic communication** Nonverbal codes: A. Kinesics B. Proxemics C. Haptics D. Vocalics E. Physical appearance F. Chronemics G. Artifacts Aspects of Body Language	6
Unit 7.	**Formal Written Skills:** Memos, Emails, Netiquettes, Business correspondence Letter of enquiry, Letter of Placing Orders, Letter of Complaint	6
	Total	**48**

	Sessional Activities	
Unit I. Interpersonal Relation	**Case Studies:** 1. from books 2. from real life situations 3. from students' experiences Group discussions on the above and step by step write of any one or more of these in the sessional copies	
Unit II Problem Solving	**Case Studies:** 1. from books 2. from real life situations	

	3. from students' experiences Group discussions on the above and step by step write of any one or more of these in the sessional copies	
Unit III Presentation Skills	Prepare a Presentation (with the help of a Power point) on a Particular topic. The students may refer to the Sessional activity (sl.No.8) of the Computer Fundamental syllabus of Semester1. For engineering subject oriented technical topics the cooperation of a subject teacher may be sought. Attach handout of PPT in the sessional copy	
Unit IV Looking for a job	Write an effective CV and covering letter for it. Write a Job Application letter in response to an advertisement and a Self Application Letter for a job.	
Unit V Job Interviews & Group Discussions	Writedown the anticipated possible questions for personal interview (HR) along with their appropriate responses Facemock interviews. The co-operation of HR personnels of industries may be sought if possible Videos of Mock Group Discussions and Interviews may be shown	
Unit 7 Formal Written Skills	Write a memo, Write an effective official e-mail, write a letter of enquiry, letter of placing orders, letter of complaint	

ENGINEERING ECONOMICS AND ACCOUNTANCY

L	T	P	*Curri. Ref. No.: G 303*
3	0	0	

Total Contact hrs.: 45 **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 70
Tutorial: 0 P.A.: 30
Practical: 0
Credit: 3

RATIONALE:

The knowledge of Economics and Accountancy is needed by personal dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers in general need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprises.

This particular subject deals with the Basic Concepts of Economics, Factors of Production, Types of Industries, Market forms, Need of Economics Planning for overall development, Concept of Money, Unemployment causes and measures, Industrial Policy, Public Finance, Business Transactions and Accountancy, Maintenance of Cash and balances, Receipts and Expenditures Accounts, Final Accounts and Cost Concepts.

DETAIL COURSE CONTENT

UNITS	TOPICS/SUB-TOPICS	HOURS
1.	**INTRODUCTION:** 1.1 Introduction to Economics and its Utility of Study 1.2 Importance of the study of economics.	1
2.	**BASIC CONCEPTS OF ECONOMICS:** 2.1 Definition of Goods, Utility, Value, Price, Income, Capital 2.2 Classification of Goods, Human Wants-Classification and Types-Relation between Wealth and Capital 2.3 Consumer Behaviour: Basic Law of Demands and Supply 2.4 Concepts and measurement of elasticity of demand	3
3.	**PRODUCTION:** 3.1 Meaning and Factors of Production 3.2 Land, Labour, Capital and Organisation – meaning and characteristics 3.3 Formation of Capital, Break Even Analysis, Break Even Chart its uses.	3
4.	**SCALE OF INDUSTRIES:** 4.1 Meaning of Small, Medium and Large Scale production 4.2 Advantages and Disadvantages of Small Scale and Large Scale Production	2

5.	**MARKET FORMS:** 5.1 Meaning of Market-Forms of Market 5.2 Features of Perfect, Imperfect and Monopoly 5.3 Price Determination under Perfect Competition & monopoly	3
6.	**ECONOMIC PLANNING :** 6.1 Basic features of underdeveloped Economy – Basic features of Indian Economy 6.2 Meaning, Objectives and Needs of Planning 6.3 Current Five Year Plan	2
7.	**MONEY :** 7.1 Meaning and Function of Money 7.2 Introduction to the concepts of the value of Money	2
8.	**UNEMPLOYMENT :** 8.1 Meaning, types and causes of Unemployment in India 8.2 Unemployment problems in India-Measures taken by the Government of India.	2
9.	**INDUSTRIAL POLICY :** 9.1 Current Industrial Policy 9.2 Monopoly Restricted Trade Practices Act (MRTP), Foreign Exchange Management Act (FEMA), Competitions Act	3
10.	**PUBLIC FINANCE :** 10.1 Meaning of Public Finance-Distinction Between Public and Private Finance 10.2 Sources of Public Revenue.	2
11.	**BUSINESS TRANSCTIONS AND ACCOUNTANCY :** 11.1 Transactions and classifications, need and objectives of proper records including double entry system 11.2 Classification of accounts and its description (in respect of real accounts, personal accounts and nominal accounts) 11.3 Debit & credit concepts: Golden rules of Debit and Credit. 11.4 Objectives and Principals of Double Entry System of Book Keeping.	5
12.	**BOOKS OF ACCOUNTS :** 12.1 Journal and Ledger, their subdivisions; posting from journals to ledger. 12.2 Balancing of Accounts	2
13.	**CASH BOOK :** 13.1 Objectives of Cash Book (in respect of all kinds of Cash Transactions) 13.2 Single Column, Double Column and Triple Column 13.3 Impress System of Petty Cash Book	2
14.	**TRIAL BALANCE :** 14.1 Objectives, Preparation – Errors and Rectification (In respect of Balance of Accounts for the Total period)	2
15.	**FINAL ACCOUNTS :** 15.1 Steps of preparing accounts: Trading Accounts, Profit and Loss Accounts	5

	15.2 Revenue and Depreciation Adjustment 15.3 Introduction to Balance Sheet	
16.	**CAPITAL & REVENUE EXPENDITURE DISTRIBUTION:** 16.1 Receipt and Payments 16.2 Income and Expenditure differences	3
17.	**MENAING AND PURPOSE OF COSTING:** 17.1 Element of Cost Analysis and Classification of expenditure for Cost Accounts. 17.2 Cost Control: Prime Cost, Overhead Cost and Indirect Material and Tools	3

REFERENCE:

1. Elements of Economics by K. K. Dewett and J. D. Verma
2. An Introduction to Economics Theory by H. L. Ahuja
3. Double Entry Book Keeping by Mohan, Juneja, Chawla and Saxena
4. Double Entry System of Book Keeping by J. R. Batliboy

ENTREPRENEURSHIP DEVELOPMENT

L	T	P	*Curri. Ref. No.: G 304*
3	0	0	

Total Contact hrs.: 45
Theory: 45
Tutorial :0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 70
P.A.: 30

RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment and culminating in economic development of the country. It deals with basic issues like entrepreneurial characteristics and quality, governmental policy support and overall scenario along with opportunities and the facilities available for entrepreneurship development.

AIM :

- Introduction
- Forms of business organisation
- Small scale and ancillary industries
- System of distribution
- Sales organisation
- Pricing the product
- Introduction to import and export
- Business enquiries
- Project report
- Environment legislation

DETAIL COURSE CONTENT

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION**	**10**
1.1	Definition and functions of Entrepreneur, entrepreneurship quality, entrepreneurial spirit, need for entrepreneurship.	
1.2	Individual and social aspects of business – achievement motivation theory	
1.3	Social responsibilities of Entrepreneurs	
2.0	**FORMS OF BUSINESS ORGANISATION**	**4**
2.1	Types of company	
2.2	Merits and demerits of different types	
2.2	Registration of small scale industries	
2.4	Conglomeration.	

3.0 SMALL SCALE AND ANCILLARY INDUSTRIES 8

3.1 Definition – scope with special reference to self employment.
3.2 Procedure to start small scale and Ancillary industries
3.3 Pattern on which the Scheme/Project may be prepared
3.4 Sources of finance - Bank, govt., and other financial institutions.
3.5 Selection of site for factory
3.6 Factors of selection
3.7 N.O.C. from different authorities, e.g., Pollution Control Board, Factories Directorate etc.
3.8 Trade License.

4.0 SYSTEM OF DISTRIBUTION 1

4.1 Wholesale Trade
4.2 Retail trade

5.0 SALES ORGANISATION 3

5.1 Market survey, marketing trends, knowledge of competitors, product selection & its basis.
5.2 Sales promotion
5.3 Advertisement
5.4 Public relations and selling skills

6.0 PRICING THE PRODUCT 1

6.1 Basic guidelines

7.0 INTRODUCTION TO IMPORT AND EXPORT 6

7.1 Procedures for export
7.2 Procedures for import
7.3 Technical collaboration – international trade
7.4 Business insurance
7.5 Rail and road transport
7.6 Forwarding formalities, FOR, FOB, CIF, etc.

8.0 BUSINESS ENQUIRIES 4

8.1 Enquiries: From SISI, DIC, SFC Dept. of Industrial Development Banks.
8.2 Offers and Quotations
8.3 Orders

9.0 PROJECT REPORT 6

9.1 Project Report on feasibility studies for small scale industries, proposal for finances from bank and other financial institutions for establishing new industries and its extension, obtaining License enlistment as supplier, different vetting organizations for Techno Economic feasibility report.
Breakeven analysis, Breakeven point.

10.0 ENVIRONMENT LEGISLATION 2

10.1 Air Pollution Act
10.2 Water Pollution Act

10.3 Smoke Nuisance Control Act
10.4 ISO: 14000, OSHA

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Entrepreneurship Development
   Prepared by CTSC Manila Publishers by Tata Mc Graw Hill Publishing Co. Ltd.
2. Small Enterprise Management Published by ISTE, Mysore
3. Motivation Published by ISTE, Mysore
4. S.S.M. in Environmental Engineering Published by ISTE, Mysore
5. Entrepreneurship New Venture Creations, Holt, Prentice Hall, India.
6. Essence of TQM by John Bank
7. Rathore, B.S. and J.S. Saini(ed), A Handbook of Entrepreneurship – Panchkula : Aapga, 1997
8. Jose Pauletal, Entrepreneurship Development, Mumbai : Himalaya Publishing House, 1996
9. Khanka, S.S., Entrepreneurship Development, New Delhi : S. Chand and Co., 2001
10. Nagarazan, R.S. and A.A. Arivalagar, TQM New Delhi : New Age International Publishers, 2005
11. Bhatia, R.C., Marketing Communication and Advertising, New Delhi : Galgotia Publishing Co., 2003
12. Sinha, J.C., and V.N. Mugali : A Textbook of Commerce, New Delhi : R. Chand and Co., 1994

PRINCIPLES OF MANAGEMENT

L	T	P	*Curri. Ref. No. G 305*
3	0	0	

Total Contact hrs.: 45 **Total marks: 100** **Theory:**

Theory: 45 End Term Exam: 70

Tutorial :0 P.A.: 30

Practical : 0

Credit: 3

RATIONALE

Management is the integrated component of all areas of technological courses as recognized across the world. Technicians or supervisors coming out of the system hence need to study the basics components of the management relevant to them. Principals of management will enable them to apply basic knowledge of management in their field of work. Keeping with this in mind necessary content details of the course on Principles of Management has been developed. With the assumption that, it will develop some management foundation to the diploma students.

AIM

- Framework of management
- Planning
- Organizing
- Staffing
- Directing
- Total quality management

DETAIL COURSE CONTENT

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1. FRAMEWORK OF MANAGEMENT	**8**
1.1 Nature of management	
1.2 Development of management thoughts	
1.3 Management and process skills	
2.0 PLANNING	**9**
2.1 Fundamentals of planning	
2.2 Planning premises and forecasting	
2.3 Decision making	
2.4 Mission and objective	
3.0 ORGANIZING	**10**
3.1 Fundamentals of organizing	
3.2 Design of organization structure	
3.3 Forms of organization structure	
3.4 Power and authority	

3.5 Authority relationship

4.0 STAFFING **8**

4.1 Fundamentals of staffing
4.2 HR planning
4.3 Recruitment and selection
4.4 Training and development
4.5 Performance appraisal

5.0 DIRECTING **6**

5.1 Fundamentals of directing
5.2 Operational control techniques
5.3 Overall control technique

6.0 TOTAL QUALITY MANAGEMENT **4**

6.1 Concepts and definitions
6.2 Sages of quality gurus and their contributions
6.3 Basic tools of TQM

SUGGESTED LEARNING RESOURCES:

Reference books:

1. Principles of management, by T.Ramasamy, Himalya publishing house
2. Management by: S. P. Robins
3. Management principles by Anil Bhat and Arya Kumar
4. Principles and practice of management by LM Prasad
5. Principles of management by LM Prasad
6. Essentials of Management by Joseph L. Massie, Prentice-Hall of India

ORGANIZATIONAL BEHAVIOUR

L	T	P	*Curri. Ref. No.: G 306*
3	0	0	

Total Contact hrs.: 45
Theory: 45
Tutorial :0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 70
P.A.: 30

RATIONALE

Knowledge in behavioural principles in an organization is an important requirement because concepts such as work motivation, behavioural patterns of individuals as also those of group of individuals etc are intimately related to it. Organizational Behavioural principles, its scopes, applicability etc. are therefore important to know by the students irrespective of the branch of specialization. Based of the above facts following content details of the subject on Organizational Behaviour has been suggested.

AIM

- Organization
- Motivation
- Developing good work habits
- Organizational culture
- Team building

DETAIL COURSE CONTENT

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**ORGANIZATION:**	**8**
	1.1 Concept and Definition	
	1.2 Structures (line, staff, functional divisional, matrix)	
2.0	**MOTIVATION :**	**10**
	2.1 Principles of Motivation	
	2.2 Aspects of Motivation	
	2.3 Job motivation	
	2.4 Theories of motivation (Maslow, Herzberg, Theory of X&Y of Mc. Gregar)	
3.0	**DEVELOPING GOOD WORK HABITS:**	**10**
	3.1 Principles of habit formation	
	3.2 Attitude and values	
	3.3 Personality-	
	- Concepts	
	- Theories	
	- Personality and Behaviour	

4.0 ORGANIZATIONAL CULTURE: 8

4.1 Concepts and its importance
4.2 Determinants of organizational culture
4.3 Rules & regulations

5.0 TEAM BUILDING: 9

5.1 Concepts Team and Group
5.2 Formation of Team building

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Organisational Behaviour - An introductory Text by Huezynski A. & Bucheman C., Prentice Hall of India
2. Image of Organisation by Morgan G. (Sage)
3. Understanding Management by Linstoand S. (Sage)
4. Organizational Behaviour bu Robbins (Prentice Hall of India)
5. Understanding and Managing by Organizational Behavior — George & Jones
6. Organisational Behaviour by L.M. PRASAD, New Delhi, Sultan Chand & Sons
7. Essentials of Management by Koontz, Tata McGraw Hill

ENVIRONMENTAL EDUCATION

L	T	P	**Curri. Ref. No. G 307**
3	0	0	

Total Contact hrs.: 45 **Total marks: 100** **Theory:**

Theory: 45 End Term Exam: 70

Tutorial : 0 P.A.: 30

Practical : 0

Credit: 3

RATIONALE :

Management of Environmental Degradation as also its control using innovative technologies is of prime importance in the times we are living in. Since the days of the famed Rio Summit (1992) awareness about degradation of environment we live in an its management through participation of one and all has literally blossomed into a full fledged movement of universal importance. Technically qualified people, such as the Diploma Engineers, should not only be aware about new technologies to combat environmental degradation at their disposal but also various aspects of environment, ecology, bio-diversity, management, and legislation so that they can perform their jobs with a wider perspective and informed citizens. This course can be taken by all diploma students irrespective of their specializations.

AIM :

- Introduction
- Ecological aspects of environment
- Natural resources
- Global environmental issues
- Environmental pollution
- Clean technology
- Environmental legislation
- Environmental impact assessment

DETAILED COURSE CONTENT

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	**2**
1.1 Introduction	
1.2 Environment and its components	
1.3 Environment in India	
1.4 Public Awareness	
2.0 ECOLOGICAL ASPECTS OF ENVIRONMENT	**8**
2.1 Ecology	
• Eco-system	
• Factors affecting Eco-system	

2.2 Bio-geochemical cycles
- Hydrological cycle
- Carbon cycle
- Oxygen cycle
- Nitrogen cycle
- Phosphorous cycle
- Sulphur cycle

2.3 Bio-diversity
2.4 Bio-diversity Index

3.0 NATURAL RESOURCES **5**

3.1 Definition of Natural Resources
3.2 Types of Natural Resources
3.3 Quality of life
3.4 Population & Environment
3.5 Water Resources
- Sources of Water

3.6 Water Demand
3.7 Forest as Natural Resource
- Forest and Environment
- Deforestation
- Afforestation
- Forest Conservation, its methods

3.8 Land
- Uses and abuses of waste and wet land

4.0 GLOBAL ENVIRONMENTAL ISSUES **9**

4.1 Introduction
4.2 Major Global Environmental Problems
4.3 Acid Rain
- Effects of Acid Rain

4.4 Depletion of Ozone Layer
- Effects of Ozone Layer Depletion

4.5 Measures against Global Warming
4.6 Green House Effect

5.0 ENVIRONMENTAL POLLUTION **9**

5.1 Introduction
5.2 Water Pollution
- Characteristics of domestic waste water
- Principles of water treatment
- Water treatment plant (for few industries only- unit operations & unit processes - names only)

5.3 Air Pollution
- Types of air pollutants
- Sources of Air Pollution
- Effects of Air Pollutants

5.4 Noise Pollution
- Places of noise pollution
- Effect of noise pollution

6.0 CLEAN TECHNOLOGY **6**

6.1 Introduction to Clean Technologies
6.2 Types of Energy Sources
- Conventional Energy sources
- Non-conventional sources of Energy

6.3 Types of Pesticides
6.4 Integrated Pest Management

7.0 ENVIRONMENTAL LEGISLATION **3**

7.1 Introduction to Environmental Legislation
7.2 Introduction to Environmental Laws

8.0 ENVIRONMENTAL IMPACT ASSESSMENT **3**

8.1 Introduction to Environmental Impact Assessment
8.2 Environmental Management (elements of ISO 14001)
8.3 Environmental ethics

SUGGESTED IMPLEMENTATION STRATEGIES:

The teachers are expected to teach the students as per the prescribed subject content. This subject does not have any practical but will have only demonstration and field visit as stated. The students will have to prepare report of the site visit.

Reference Books:

1. Environmental Engineering by Pandya & Carny, Tata McGraw Hill, New Delhi
2. Introduction to Environmental Engineering and Science by Gilbert M. Masters Tata McGraw Hill, New Delhi
3. Waste Water Engineering – Treatment, Disposal & Reuse by Metcalf & Eddy Tata McGraw Hill, New Delhi
4. Environmental Engineering by Peavy, TMH International New York
5. Environmental Science by Aluwalia & Malhotra, Ane Books Pvt. Ltd, New Delhi
6. Text Book of Environment & Ecology by Sing, Sing & Malaviya, Acme Learning, New Delhi
7. Environmental Science & Ethics by Sing, Malaviya & Sing, Acme Learning, New Delhi
8. Environmental Chemistry by Samir K. Banerji, Prentice Hall of India, New Delhi
9. Study / training materials, references, reports etc. developed by Central Pollution Control Board, New Delhi as well as State Pollution Control Boards

(b) Others:
1. Text book mentioned in the references
2. Lab Manuals
3. OHP Transparencies
4. Video film on Environment

SUGGESTED LIST OF DEMONSTRATIONS/FIELD VISIT

- pH value of water sample.
- Hardness of water
- Calcium hardness
- Total Hardness
- Residual Chlorine to a given sample of water
- Turbidity
- B.O.D.
- C.O.D.

Visits: Following visits shall be arranged by the teachers during the semester:

- Water Treatment Plant
- Sewage Treatment Plant
- Maintenance work of water supply mains and sewage system

BASIC TECHNOLOGY COURSES

ELECTRICAL CIRCUITS & MATERIALS

L	T	P		
3	0	2		***Curri. Ref. No.: EE 401***
Total Contact hrs.: 75			***Total marks: 150***	**Theory:**
Theory: 45				End Term Exam: 70
Practical: 30				P.A.: 30
Pre requisite:				**Practical:**
Credit: 4				End Term Exam: 25
				P.A : 25

RATIONALE:

The concept of electrical Circuit is very essential for the study of the other subjects in Electrical Engineering. This subject covers the basic electrical principles both on d.c. and a.c. circuits. The fundamental principles of Magnetic circuits have also been covered. The concept of transients and Fourier have been included here. The knowledge of Electrical Engineering Material in Electrical Engineering plays an important role. The technicians who will be completing the course under Diploma Engineering Scheme will be entrusted to select the proper materials for the use as conductor, semiconductor and insulator. Resistance materials are used for different purposes as potential divider, heating and controlling element. This subject provides the necessary information regarding all above materials so that the student can select the suitable materials for the definite purposes.

AIM:

a) To develop the concept on basic electrical circuit principles.
b) To develop problem solving ability on electrical circuit principles.
c) To describe the properties of different electrical Engineering Materials.
d) To develop the skill for selection of right material for right job.
e) To develop the skill for suggesting the substitute of the replacement material when it is not available in ready stock.

DETAILED COURSE CONTENT:

Unit	Topic/Sub Topic	Hours
1.	**Materials for Conductors, Resistors and Insulator**	**4**
	1.1 Classify electrical material based on 1.1.1 Their properties and applications 1.1.2 Their atomic structure 1.2 To describe the properties of 1.2.1 Conductors, Semiconductors 1.2.2 Superconductors 1.2.3 Instalators 1.3 To state the important Electrical & Mechanical characteristics of 1.3.1 Good conducting materials 1.4 Describe the application and properties of important resistance materials like Tungsten, Carbon, Nichrome manganin, Eureka, Platinum	

	1.5 To classify the Insulating Materials in terms of temperature ranges (e.g. Class O, Class Y)	
2.	**Dielectric Material** 2.1 To define Dielectric strength, Dielectric loss, Dissipation factror, the factors affecting dielectric loss 2.2 To state the relation between Relative permittivity and Dielectric strength. 2.3 To describe conduction through 2.3.1 Gaseous Dielectric 2.3.2 Liquid Dielectric 2.3.3 Solid Dielectric 2.4 To state the application of Dielectrics	**6**
3.	**Insulating Waxes, Varnishes and coolants** 4.1 To describe properties and application of 4.1.1 Insulating varnishes 4.1.2 Coolants in Electrical machines 4.2 To list the name and important properties of some common type of coolants (e.g. Transformer oil, Nitrogen, Silicon Varnish) 4.3 Describe the effect of Contamination	**2**
4.	**Magnetic Material** 4.1 To define 4.1.1 Ferromagnetic material 4.1.2 Paramagnetic material 4.1.3 Diamagnetic material 4.1.4 Curie point 4.2 To draw and explain the hysteresis loop for different materials like hard sheet, wrought iron and alloy steel 4.3 To state the effect of adding impurities in Ferromagnetic materials 4.4 State the properties of 4.4.1 electromagnetic steel and alloys 4.4.2 CRGO 4.4.3 Dynamo Grade steel 4.4.4 Ferrites 4.4.5 ALNICO 4.4.6 Hard Ferrites	**4**
5.	**Magnetic Circuits** 5.1 To understand the relation between Magnetic flux and magnetic intensity. 5.2 To define permeability, retuctance, permeance. 5.3 Describe magnetic circuit and comparison with electrical circuit. 5.4 To define series, parallel and composite magnetic circuit. 5.5 To enumerate the energy stored in magnetic field. 5.6 To determine the pulling force by an electromagnets.	**5**
6.	**Passive Circuit Elements** 6.1 Resistance, capacitance, Inductance 6.2 To define resistance, capacitance & Inductance (Self & Mutual) 6.3 To write the expression relating resistance & resistivity.	**6**

	6.4 To write the expression of capacitance in terms of areas and distance between plates. 6.5 To write the expression for inductance relating to its physical dimensions. 6.6 To write the equation relating voltage, current & resistance. 6.7 To write the expression relating to charge, capacitance & voltage. 6.8 To write the expression relating to voltage current & inductance. 6.9 To write expression for energy dissipated in resistance & energy store in capacitance and Inductance. 6.10 To solve simple problems resistance, capacitance & Inductance.	
7.	**D.C. Circuits** 7.1 To define voltage and current source 7.2 To represent graphically the ideal current and voltage source 7.3 To represent graphically the practical voltage and current source 7.4 To describe series parallel combination and determine the equivalent resistance 7.5 To deduce the conversion formulae for Delta to Star and vice-versa 7.6 To state 7.6.1 Kirchhofff's current law 7.6.2 Kirchhofff's voltage law 7.6.3 Superposition theorem 7.6.4 Norton's theorem and Thevenin's Theory 7.6.5 Maximum power transfer theorem 7.6.6 To solve the D.C network problems using above theorems and laws	**8**
9.	**Series and parallel Resonance** 9.1 To state the condition for series resonance 9.2 To determine the expression of frequency at resonance condition 9.3 To define quality factor & band width 9.4 To state the condition for parallel resonance 9.5 To determine the resonance frequency for parallel L-C Circuit 9.6 To solve problems on series and parallel resonance	**8**
	Class Test	**2**

LIST OF EXPERIMENTS

1. Identification of Passive Components
2. Performing the good bad test of Passive Components
3. To verify Kirchhoff's Current Law and Voltage Law
4. To verify Superposition Theorem
5. To verify Thevenin's Theorem
6. To develop the charging and discharging curve of voltage across the capacitor connected in series with a resister
7. To measure the voltages across R, L, C in a series RLC circuit. To develop phaser diagram.
8. To verify maximum power transfer theorem

9. To determine the resonance frequency and Q-factor in a series LC circuit
10. To determine the resonance frequency and Q-factor in a parallel LC circuit

REFERENCE:

1. Electronics and Electrical Engineering by Lionel Warnes, Macmillan
2. Electrical Engineering Material by N. Alagappan and NT Kumar, TATA McGraw Hill Publishing Company Limited
3. Electrical Egg. Materials, NITTTR, Madras.
4. A course in Electrical Engineering Materials, S.P. Seth, P.V. Gupta, Dhanpat Rai & Sons.
5. Electrical Engineering Materials, A.J. Dekker, PHI.
6. Materials Science for Electrical & Electronics Engineers, Ian P. Jones, Oxford
7. Electrical Properties of Materials, L. Solymar & D. Walsh, Oxford
8. Introduction to material science for engineers, J.K. Shackelford & M.K. Muralidhara, Pearson Education.

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

L	T	P	*Curri. Ref. No.: EE 402*
3	0	2	

Total Contact hrs.:75 ***Total marks: 150*** **Theory:**

Theory: 45 End Term Exam: 70

Practical: 30 P.A.: 30

Pre requisite: **Practical:**

Credit: 4 End Term Exam: 25

P.A : 25

RATIONALE:

The subject Electrical Measurement and Measuring Instrument is an important subject in the field of Electrical Engineering. This subject deals with the technique of measuring voltage, current and wattage by the indicating type of instruments. The technique of measurement of Electrical power in single phase and three phase circuits will be studied here. Measurement of energy and calibration and adjustment of energy meters will be studied under this subject. Prior to above the working principle construction of all type of measuring instruments like indicating, integrating and recording type will also be studied here. Uses of potentiometers and other resistance measuring instruments are included under this subject. It is noteworthy to mention that the modern industries are implementing digital instruments for measuring electrical quantities but till date the conventional instruments are being used for this reason the importance of studying the subject "Electrical Measurement and Measuring Instruments" still exists. However the provision for studying the construction and working principle of advanced electrical instruments such as digital instrument may be made in a separate subject.

AIM:

1. To acquire the skill for selecting similar instruments for the measurement of voltage, current and wattage.
2. To learn the technique connecting different type of Electrical measuring instruments.
3. To learn the technique of calibrations and adjustment of different type of electrical measuring instruments.
4. To explain the working principle and construction of different type of Electrical Measuring Instruments.

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hour
1.	**Introduction**	**3**
	1.1 Systems of Units • To describe base units with examples • To describe derived units with examples • To indicate the units and dimensions of the following: frequency, speed, acceleration, force, work, energy, power, charge, potential reactance, Conductance, capacitance, inductance, magnetic field, flux density, magnetic flux.	

- Discussion on drawbacks of: Electrostatic System, Electromagnetic System.
- To define the following: SI units and analyse the dimension of Newton, Joule, Newton meter, watt, Ampere, Coulomb, Ohm, Volt, Farad, Weber, Henry Self inductance, mutual inductance unit magnetic pole, Ampere turn, Ampere turn per meter, Tesla

2. Types of Instruments: **3**

2.1 To classify different type of instruments e.g. indicating integrating, and recording.

2.2 To describe type of (a) deflection system (b) Controlling System and (c) damping systems.

2.3 To describe the advantage and disadvantages of above mentioned systems.

2.4 To describe the constructional detail of pointer, control spring and Instrument bearings.

3. Construction and Working principles **8**

To describe the constructions, working principles for following instruments

3.1 moving coil instruments

3.2 moving iron instruments

3.3 Electrodynamic instruments (air cored and iron cored)

3.4 Induction instruments

3.5 Electrostatic Instruments

3.6 Thermal instruments

3.7 Describe the above principles in case of Ammeter, Voltmeter Wattmeter and PF meter

4. Extension of Range of instruments and conversion **3**

4.1 To describe the method of extensions of range of ammeters and Voltmeters (D.C Meters) describe the concept of Swamping resistor

4.2 To describe the method of extension of range of ammeter and voltmeter (A.C meters). Uses of C.T and P.T and their working principles

4.3 To describe the working principles of rectifier type instruments

4.4 To Solve of Problems on above concepts

5. Measurement of Resistance **6**

5.1 To classify the resistance according to the range values

5.2 To define the accuracy of measurements

5.3 To describe method of measurement of resistances

5.3.1 To state ammeter voltmeter method of measurement (Connection for ammeter for different ranges of resistance state the sources of error in different measurement techniques)

5.3.2 To state method of substitution for the measurement of resistance. Discuss the sources of error

5.3.3 To state Wheatstone bridge principle of measurement of resistances with precautionary measures

5.3.4 To describe the concept of meter bridge and P.O box principles, discuss about the sources of error

5.3.5 To describe the Kelvin-Double bridge principle. Deduce the expression for calculation for the value of unknown resistance. Discuss the methods for eliminating the errors for measurements.

5.3.6 To describe the basic principles of series and shunt ohmmeter

5.3.7 To describe the principles of crossed coil or Ratio ohmmeter. Describe for low resistance and high resistance measurement

5.3.8 To describe the constructions working principles of Megger. State the type of Megger tester and their field of application (Insulation Tester & Earth Tester). State the recommendation of Bureau of Indian Standard Specification for selection of voltage for testing. State the effect of capacitance of cable regarding the selection of Megger. State the effect of use of guard ring in Megger.

5.3.9 To state the method of measuring the insulation resistance while the power is on.

5.3.10 To solve problems on above topic/subtopic

6 Measurement of Power 6

6.1 To describe the method of connecting a wattmeter for measurement of single-phase power

6.2 To describe the method of measuring single phase power by (a) three ammeter and (b) three voltmeter method

6.2.1 To describe the method of measurement of p.f by using wattmeter, voltmeter and Ammeter in single-phase circuit.

6.3 To describe the method of three phase power by two wattmeter method, Deduce the expression for measurement of total power and the p.f of the circuit for the balanced load conditions. State the precaution to be taken for the measurement of Power in low p.f load condition

6.4 To solve problems on power measurement

7.0 Energy Meter 6

7.1 To describe the construction and working principle of D.C Energy meters

7.2 To describe the construction and working principles of Induction Type Energy Meter.

7.2.1 To describe the method of testing of Energy meter

7.2.2 To describe the method of construction of three phase Energy meters

7. 3 Solve problems on Energy meter Testing

8. Bridges and Potentiometers 8

To describe the principles of A.C Bridges on the following

8.1 Capacitance comparison Bridge

8.2 Inductance comparison Bridge

8.3 Describe the precautionary measure to be taken for high frequency measurement

8.4 Description of the method of Wagner's Earth Connection

8.5 Solution of problems on above concepts

9. Class Test 2

LIST OF EXPERIMENT

1. Dismantling and Assembly of indicating type instrument PMMC type, identification and drawing the following
   (a) Deflecting system
   (b) Controlling System
   (c) Damping System
2. Dismantling and assembly of indicating type instrument eg. Electro-dynamic Wattmeter, identification and drawing of (a) deflecting System(b) Controlling System (c) Damping System (d) current coil (e) potential coil (f) voltage multiplier
3. Dismantling and assembly of indicating type instrument e.g. Moving Iron Voltmeter and Ammeter, identification and drawing of (a) deflecting system (b) Controlling System and damping system.
4. Dismantling and assembly of rectifier type voltmeter
5. 5.1 Dismantling and assembly of Single phase energy meter, identification and drawing of (a) deflecting system (b) braking system (c) current coil (d) potential coil (e) creep adjustment (f) Pf adjustment (g) speed adjustment
   5.2 Calibration of single phase Energy Meter and Phantom loading and power factor
6. Measurement of power by three Voltmeter methods
7. Measurement of power and power factor by three-ammeter method
8. Measurement of three phase power & power factor by 2 wattmeter method
9. Extension of Range of a PMMC voltmeter
10. Connection of CT and PT for measurement of high current and high voltage and determination of trans ratio of current and potential transformer
11. Measurement of resistance by Wheatstone Bridge (and Kelvin's Double Bridge)
12. Measurement of Medium Value resistance by Ammeter Voltmeter method
13. Study of HV oil Testing set
14. Measurement of dielectric strength of transformer oil by oil testing set
15. Localization of cable fault by Murray loop test

REFERENCE:

1. Electrical Measurement and Measuring Instruments by Golding
2. Electron Instrumentation by H.S. Kalsi, T.M.H
3. Electrical Measurements and Measuring Instruments by E. Handscombe, The Wykeham Technologies Service
4. Electrical Measurement and Measuring Instruments by S. R. Paul, Rukamari Book House Calcutta
5. Electrical Measuring Instruments by S. R. Paul, Concept Publications.

ELECTRICAL MACHINE - I

L	T	P	*Curri. Ref. No.: EE 403*
3	0	2	

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
P.A.: 30
Practical:
End Term Exam: 25
P.A : 25

RATIONALE:

The application of D.C. Machine in Modern Industries are still in practice. The Electrical Engineering Technicians has to look after the installation, operation and control of Machines. So the knowledge of Machine are very essential in this regard. As the field of Electrical machine is very vast, this subject is divided into two parts Electrical Machine I and Electric al Machine II. The Electrical machine I deals with D.C. Machines, transformers and Different type of Batteries. Though modern industries are now-a-days uses ac. Motors and alternating mostly, the usage of DC Machines like D.C. Motors, Generators are still in practice. The usage of transformers and batteries are very wide for that reason these topics have been included in this subject. This subject deals with the working principles, operation of the machines. Special emphasis have been given on the maintenance, repair of the above machine also.

AIM:

1. To acquire knowledge on the construction and working principles of D.C. Machine, Transformer and Battery.
2. To describe the installation and maintenance procedure of D.C. Machines, Transformers and Batteries
3. To describe the charging methods of the batteries

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours

1. D.C. Machine **6**

1.1 Construction & Working principle of D.C. Machines, Fleming's Right Hand and Left Hand Rule.

1.2 To describe the Magnetic Circuit in a D.C. Machine

- 1.2.1 To define geometrical axis and central axis.
- 1.2.2 To describe Armature Winding
- 1.2.3 To describe the brush positions
- 1.2.4 To define lap and wave winding
- 1.2.5 To state the field of application of Lap and Wave winding
- 1.2.6 To state the function of equalizing ring and dummy coils
- 1.2.7 To state the types of D.C. machines
- 1.2.8 On the basis of connection of field Coil with armature.
- 1.2.9 To define cumulative and differential compound machines.

2. D.C. Generator. 6

2.1 To describe the working principle of D.C. Generator
- 2.1.1 To write the emf. Equation of D.C. Generator
- 2.1.2 To state the method of determining O.C.C. curve of D.C. Generator (self excited)
- 2.1.3 To define critical resistance and critical speed
- 2.1.4 To describe the armature reaction
- 2.1.5 To state the method of reducing the effect of armature reaction
- 2.1.6 To describe the load characteristics of D.C. Generator
- 2.1.7 To state the application of D.C. Generator
- 2.1.8 To solve problems on D.C. Generator

3. D.C.Motor 12

3.1 To describe the working principle of D.C. Motor
- 3.1.1 To state the significance of back emf
- 3.1.2 To write the torque equation of D.C. Motor
- 3.1.3 To describe the characteristics of
  - a) Speed Vs. armature Current
  - b) Torque Vs. armature current
  - c) Speed Vs. torque characteristics.
  - d) Speed Vs. field current characteristics
- 3.1.4 To state the field of application of Different type of D.C .Motor
- 3.1.5 To state the basic principle of starting of D.C. Motors
- 3.1.6 To describe the speed control of D.C. Motor by By varying field current ii) By varying armature voltage
- 3.1.7 To describe the speed reversal method of D.C. Motor solve the problems on D.C. Motor (specify the areas)

4. Transformer : 10

4.1 To define a Transformer & state its basic principle

4.2 To state the classification of transformer based on
- 4.2.1 application
- 4.2.2 construction

4.3 To describe the construction of transformer
- 4.3.1 To prepare the list of components used
- 4.3.2 To describe the composition of the components
- 4.3.3 To state the type and nature of cooling of transformers

4.4 To describe the working principle of transformer.

4.5 To describe transformer on (a) no-load (b) full load

4.6 To derive the emf equation of transformer

4.7 To state the effect of leakage flux and leakage reactance of transformer

4.8 To describe the Phasor Diagram on no load (specify whether ideal or actual)

4.9 To describe the actual approximate equivalent circuit

5.0 To determine the equivalent resistance, reactance impedance referred to either side

4.11 To determine percentage resistance, reactance & impedance of transformer

4.12 To draw the phasor diagrams on load at different pf's

4.13 To describe different type of losses in transformer

4.14 To calculate the losses and efficiencies of transformer

4.15 To state the condition for maximum efficiency of transformer
4.16 To state the procedure for testing of transformer
4.17 To describe the open circuit test and short circuit test
4.18 To determine the voltage regulation of a transformer
4.19 To describe the construction of Auto transformer
4.20 To describe the working principle of Auto transformer

5 Storage Batteries : 8

5.1 To state the types of storage batteries
5.2 To describe the construction of Lead Acid battery
5.3 To describe the working principle of Lead Acid Battery
5.4 To describe the special feature of Maintenance free battery
5.5 To describe the features in Emergency light batteries
5.6 To state the defects in storage batteries
5.7 To describe the method of battery maintenance
5.8 To describe different method of battery charging
5.9 To describe different battery charging circuit for (a) constant voltage (b) constant current charging
5.10 To describe the method of testing, fault diagnosis and repair of batteries
5.11 To describe the safety procedure for battery
5.12 To describe the method for prevention of environmental pollution

6. Class Test: 3

LIST OF EXPERIMENT

1. Dismantling of a d.c. machine and study its different parts.
2. Determination of No load characteristics/Drawing of OCC curve of D .C. Machine
3. Study of a single phase Transformer
4. Polarity Test on a single phase transformer
5. To determine the speed torque, speed armature current and torque armature current characteristics of a D.C. Motor (Shunt and Compound).
6. To control the speed of a D.C. Shunt Motor by (a) armature voltage Variation (b) field current variation.
7. To assemble and test the speed reversal circuit of a D.C. Shunt Motor
8. To study of transformer on No load and draw the no load phasor diagram
9. To determine the (a) no load loss (b) full load loss (c) efficiency and percentage regulation of a single phase transformer.
10. To determine the phasor diagram of transformer on load at different pf's
11. To study the detail construction, assembly and installation of a lead Acid battery
12. To study the construction of Different battery chargers e.g.
    a) Taper charger/constant voltage charger
    b) Constant current charger
    c) Auto cut off battery charge
13. To study the construction of Maintenance free battery.

REFERENCE:

1. Batteries and Energy System by Mantell, McGraw Hill.
2. Storage Batteries by Vinal, John Willey & Sons.

ELECTRICAL MACHINE - II

L	T	P	*Curri. Ref. No.: EE 404*
3	0	2	

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite: EE 403
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
P.A.: 30
Practical:
End Term Exam: 25
P.A : 25

RATIONALE:

The subject Machine II is a subject, which deals with the Induction Machine, synchronous Machine and fractional Horse Power Motors. In this subject the construction, working principles, starting principles are to be studied. The testing of the machines and the brief design ideas have also been included here. In addition to the theoretical study of the topics as mentioned above care has been taken for including the practical aspects of the topics. A few problems have also been included here, so that the student can develop the problem solving attitude during their service career.

AIM:

- To describe the construction and working principles of induction motor
- To describe the construction and working principles of synchronous machines
- To describe the construction and design principles of fractional horse power motors
- To describe the construction and working principles of special type of motors eg D.C. brushless Motor and stepper motor
- To describe the method of starting of induction motor
- To describe the testing and installation procedure of induction motor and synchronous machines

DETAIL OF COURSE CONTENT

Unit	Topic/Sub Topic	hour
1	**Induction Motor** 1.1 To explain the constructional features of three phase induction Motor 1.2 To explain the method of the production of rotating magnetic field produced in a three phase stator winding when three phase supply is applied in it. 1.3 To define slip, synchronous speed 1.4 To describe the working principle of a three phase induction motor 1.5 To develop an expression for torque in three phase induction Motor 1.6 To draw the torque speed characteristics of a three phase induction motor 1.7 To explain (a) the effect of variation of applied voltage of torque speed characteristics (b) the effect of variation of rotor resistance on torque speed characteristics	**15**

	1.8	To explain various methods for starting induction Motor	
	1.9	To explain the modern techniques of starting different type of induction Motor	
	1.10	Explain different method of speed control in three phase induction motor (conventional Method)	
	1.11	Explain the modern method of speed control of three phase induction motor	
	1.12	State and enumerate different losses in three phase induction motor	
	1.13	To determine the efficiency of three phase induction motor considering the losses in the motor	
	1.14	To develop the Electrical equivalent circuit of three phase induction motor	
	1.15	To calculate the torque developed, current drawn, power factor, motor speed of three phase induction motor (usage of standard equation) and data	
	1.16	To describe the testing procedure of three phase induction motor for determining the performance characteristics	
	1.17	State various factors involved in installation of a three phase induction Motor	
	1.18	To state various steps for the maintenance of induction motor	
	1.19	To state the various faults and testing methods for remedial measures	
	1.20	To explain the working principle of single and three phase induction regulator	
2	**Three Phase Synchronous Machine**		**10**
	2.1	To explain the constructional detail of three phase synchronous Machine	
	2.2	To explain the method of inducing poly phase voltage in a synchronous generator	
	2.3	To describe the advantages of a rotating magnetic field system in a synchronous machine over a rotating armature system.	
	2.4	To explain the basic principle of developing three phase armature windings.	
	2.5	To derive the emf Equation and explain the need for (a) distributed winding (b) making a short pitched winding	
	2.6	To explain the armature reaction and its effect on different load of different power factor	
	2.7	To determine voltage regulation by synchronous impedance method	
	2.8	To describe the methods of testing the synchronous machines and to determine their performance characteristics	
	2.9	To describe the method of synchronising the incoming alternator with three phase bus bar or a running alternator.	
	2.10	To state the conditions for load sharing between two alternators in synchronised mode.	
	2.11	To explain why synchronous motor is not self-starting.	
	2.12	To explain the effect of change in excitation of a synchronous motor on armature current.	

	2.13 To state application of synchronous machine. 2.14 To state the condition/factors for the application of synchronous machine	
3	**Single Phase Motors** 3.1 To list various type of single phase motors 3.2 To explain the construction & operating principle of various type of inductor motor (split phase type). 3.3 To explain the double revolving field theory. 3.4 To explain double revolving field theory. 3.5 To explain the construction and working principles of single phase commutator motor 3.6 To explain the construction and working principle of shaded pole type single phase induction motor 3.7 To draw the performance characteristics of all above type of single phase motors 3.8 To describe the testing procedure of single phase induction motor and measurement of (1) speed (2) power consumption (3) torque	**10**
4	**Special Machines** To explain the construction and working principle of 4.1 Linear A.C Motor 4.2 Brush less D. C. Motor 4.3 Stepper Motor 4.4 A.C. Drag cup type servomotor 4.5 D. C. Servomotor	**6**
5	**Class Test**	**4**

LIST OF EXPERIMENTS

1. To determine the slip of an induction motor
2. To perform the insulation resistance test of three phase induction motor
3. To perform the no-load test of the three phase induction motor
4. To perform the blocked rotor test of a three phase induction motor
5. To perform the pony brake method of the speed current and speed torque characteristics
6. To determine the effect of rotor resistance on the torque speed curves of an induction motor
7. Determination of Magnetisation characteristics of an alternator (a) at no load rated speed (b) at no load half rated speed (c) at full load (non-induction) rated speed
8. Determination of the relationship between terminal voltage and load current of an alternator, keeping excitation and speed constant.
9. Determination of regulation and efficiency of an alternator from open circuit and short circuit
10. Synchronization of alternator to infinite bus / another alternator.
11. Determination of V-curves of a synchronous machine.
12. Parallel operation of three-phase alternator and load sharing

REFERENCE:

1. Electrical Machines by Dr. S. K. Bhattacharya, T.M.H.
2. Electrical Machines by J. D. Edwards, Mackmillan.

ELECTRICAL POWER SYSTEM - I

L	T	P	*Curri. Ref. No.: EE 405*
3	0	0	

Total Contact hrs.: 45 ***Total marks: 100***

Theory: 45
Practical:
Pre requisite:
Credit: 3

Theory:
End Term Exam: 70
P.A.: 30
Practical:
End Term Exam: Nil
P.A : Nil

RATIONALE:

The knowledge of power generation and the substations are very essential in the field of Electrical Engineering. The role of the technician in maintaining a generating station and substation is vital. Some emphasis have been given on the maintenance aspects of Power generating station and substation. As the power crisis in this country is increasing day by day with the increase in power demand the utilisation of Diesel -generating set is also increasing. Hence the detail study of diesel generating sets as a captive power-generating unit is to be studied here.

AIM :

1. To develop the knowledge in detail on
   a) Thermal Power Plants
   b) Hydro Electric generation unit
   c) Nuclear Power generating station
   d) Diesel generating Unit
2. To furnish a list of generating station. Auxiliaries for above generating System
3. To develop the maintenance schedule for above generating stations
4. To prepare the layout of different types of sub station
5. To develop maintenance schedule of the substations

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours

1. Generation of Electrical Power **15**

1.1 To state the name of the sources of Energy

1.2 To describe the factors on which the following generating systems are implemented
(a) Thermal Power station (b) Hydro Electric Power Station
(c) Atomic Power stations (d) Gas Turbine (e) Diesel generating systems

1.3 Thermal Power generation

1.3.1 To describe the detail layout of thermal power station

1.3.2 To state the factors for site selection and furnish the list of thermal power plants

1.3.3 To state the generating capacity of the thermal power station.

1.3.4 To describe the working principle of the following(a) Coal handling Plant (b) Alternators (c) condensing plant (d)Water treatment plant (d)Ash handling system (f)Station auxiliaries (g) pulverising system (h) steam generation system (i) turbine system (i) Electrostatic Precipitator (ESP)

1.4 Hydro Electric Power generation

1.4.1 To state the reasons for developing a Hydro Electric Project

1.4.2 To describe different type of hydro electric project

1.4.3 To furnish a list of hydro electric projects and their capacities

1.4.4 To describe the detail layout of the hydro electric project

1.4.5 To describe the alternator, & turbine of the hydro electric projects

1.4.6 To describe the station auxiliaries of the hydro electric projects

1.5 Atomic Power Generation

1.5.1 To state the reasons for selecting Atomic Power Station as a power-generating unit

1.5.2 To state the factors on which the site is selected

1.5.3 To state different types of Atomic reactors used in Power generating system

1.5.4 To describe the detail layout of the Atomic Power generating system

1.5.5 To describe the safety system needed for the running and maintenance of the Atomic Power generating system

1.5.6 To state the advantages and disadvantages of Atomic Power generating system

1.6 Diesel Generating Plants

1.6.1 To state the reason for selection of Diesel generating system as power generating unit

1.6.2 To state the capacities of the Diesel generating System

1.6.3 To describe the schematic layout of the Diesel generating System

1.6.4 To describe the starting procedure of a Diesel generating System

1.6.5 To furnish the list of materials and components required for the operation and maintenance of Diesel generating Set

1.6.6 To state the relevant IE rules for connecting the Diesel generating set with the bus bar

1.6.7 To prepare the maintenance schedule

1.6.8 To prepare the testing schedule for the repair work during breakdown

1.7 Gas Turbine

1.7.1 To state the reason for selecting gas turbine

1.7.2 To prepare the layout of the gas turbine

1.7.3 To explain the working principle of the gas turbine

1.7.4 To state the advantages & disadvantages of gas turbine

1.8 To perform the comparative study of steam, Hydel, Atomic, Diesel generating and gas turbine plants

2. Power Planning Economic and Tariff 8

2.1 To define
(a) Demand (b) Load Curve (c) Maximum Demand or Peak Load (d) Connected load (e) Demand factor (f) Load factor (g) Diversity factor (h) Plant Factor

2.2 To solve the problems on above

2.3 (a) To describe the factors involved for determining cost of generation
(b) To solve problems on 2.3 (a)

2.4 (a) To describe the method of determination of size of conductors and apply Kelvin's law
(b) Solve problems on 2.4(a)

2.5 (a) To describe the method of (i) load survey (ii) Planning (iii) calculation for Tariff
(b) To solve problems on 2.5 (a)

2.6 (a) To describe the method of power factor improvement of a plant
(b) To solve problems on 2.6(a)

2.7 (a) To describe the factors involving the economic choice of Equipment
(b) To explain power auditing

3. Power Installations and Drives 7

3.1 To define power installation

3.2 To list and explain the factors on which a power installation is designed

3.3 To prepare a layout of an Industrial Power Distribution System

3.4 To describe the methods for the selection of drive in an industrial system

3.5 To state and explain the factors on which the motor is selected

3.6 To prepare a table stating the properties and application of Different type of Motor

3.7 To describe the method for the choice of device for specific Industrial Utility

3.8 To design and estimate for a 400 V, three phase 4 wire bus bar system (Power derived from 3 phase 11 KV system)

4. Sub Station 7

4.1 To define substation

4.2 To prepare the list of equipment of a sub-station

4.3 To design the layout of a transmitting sub-station

4.4 To design the layout of (a)Primary distribution sub-station
(b) Secondary distribution sub-station

4.5 (a) To describe the method of Earthing the Substation
(b) To describe the earthing systems as per Bureau of Indian Standard
(c) To state the relevant IE Rules for sub-station earthing

4.6 (a) To distinguish between Earthed versus Isolated neutral power system
(b) To describe the reason for neutral point earthing

4.6.1 To describe the method of Inspection and Maintenance of (a) Switchgear (b)Transformer (c) Transformer oil (d) Bus bars (e) Power factor improvement devices

4.6.2 (a) To describe the method of transformer oil testing
(b) Describe the effect of contamination

(c) To describe the method of filtering and reconditioning of transformer oil
(d) Properties and application of mineral oil
(e) State the relevant code for the transformer oil testing

5. Battery Bank **5**

5.1 To describe the detail of connection and function of a battery bank

6. Class Test **3**

REFERENCE:

1. Electrical Power by S. R. Chakraborty, Venus Publishers.
2. Electrical Power System by Subir Roy, Prentice Hall
3. Power System Engineering by Nagrath & Kothary, TMH
4. Electrical Power System by C.L.Wodhwa, New Age International
5. Elements of Power System Analysis by W.D. Stevens, McGraw Hill International

ELECTRICAL POWER SYSTEM II

L	T	P	*Curri. Ref. No.: EE 406*
3	0	0	

Total Contact hrs.: 45
Theory: 45
Practical: Nil
Pre requisite: EE405
Credit: 3

Total marks: 100

Theory:
End Term Exam: 70
P.A.: 30
Practical:
End Term Exam: Nil
P.A : Nil

RATIONALE:

The subject power system has different parts like power generation. Transmission % Distribution of Switch gear and protection. Since the topics in the above sections covers very vast areas, it is required to drive the subject into three different major parts e.g. (i) Power generation (b) Power Transmission & Distribution (c) Switch Gear & Protection. As the subject power Transmission and Distribution is more or less descriptive and based on the study of structure of transmission line. Construction of lines, overhead safety device, services, service connections, estimating work, these topics are included in power system. Some care has been taken to include the study of the equipment, accessories and systems which have been developed very recently. The related IE rules and Bureau of Indian Standard Specifications have also been included here.

AIM :
To acquire knowledge on

- Principles of Distribution System
- Materials of Overhead Lines
- Concept on Line Design
- Concept on Line Construction
- Concept on Lighting Arrestors
- Details of Service Connection
- Construction Details of underground cables
- Maintenance of Transmission & Distribution Lines
- HVDC transmission lines
- IE Rules

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1.	**Principles of Transmission and Distribution**	**4**
	1.1 To describe the transmission System and Distribution System	
	1.2 Short and Medium Transmission line, current voltage relation, Performance of Short Transmission line.	
	1.3 To describe the distribution systems eg.	
	a) Radial system	
	b) ring main system	

1.4 To describe
D.C. two wire system
D.C. three wire system
(a) Single phase A.C
(b) Three phase A.C. System

1.5 To determine the copper efficiency of
D.C. two wire & three wire system
(a) Single phase A.C
(b) Three phase 3 wire. System
(c) Three phase 4 Wire system

1.6 To determine the current loading in three phase 4 wire and three wire feeder system

1.7 To determine the voltage drop in A.C Feeder (Single phase)

1.8 To determine the voltage drop in three phase AC Feeder

1.9 To describe the A.C distributor and determining the sending end voltage

2 Materials of Overhead Line **4**

2.1 To describe the construction characteristics their applications of
a) Line Conductor (types & properties)
b) Poles
c) Wooden poles and their Treatment
d) Concrete Poles
e) Steel tubular poles
f) Rail Poles
g) Steel towers with cross arms brackets
h) Stays, struts and other line accessories like Arcing Horns etc. suspension clamp, strain clamp, snail clamp, tubular compression dead end, etc and binding wires dampers etc

2.2 To describe the construction, characteristics and field of application of
a) Shackle Insulators
b) Pin Insulators
c) Post Insulators
d) Disc Insulator
e) String Insulators

3 Concepts on line Design **3**

3.1 To describe the rules and practices on Selection of Number of phases
b) Selection of conductor size
c) Arrangement and spacing of conductor
d) Selection of height of poles or Towers
e) Clearances between power lines
f) Selection of span
g) Calculation of Sag
h) Maintaining the clearance from building (Vertical & Horizontal)

i) Maintaining the clearance between powerlines & telelines, railway crossing, River crossing

j) Earthing and counterpoise of transmission and distribution line

4 Line Construction **2**

To describe different steps in line construction

4.1 Using Poles e.g.

a) Methods of line survey

b) Installation procedure of poles

c) fixing of fittings and fixtures

4.2 Using Towers **2**

a) construction of Towers

b) Method of Tower Earthing

c) Method of installing insulator string, dampers

d) paying out & stringing of conductors

e) Preparing different type of conductor joints

5 Service Connection & Tests **5**

To describe

5.1 Layout of the low and Medium voltage Distribution system

5.2 To describe the detail of service connection of overhead line (low and Medium voltage)

5.3 To describe the detail of service connection of underground system.

5.4 To describe the detail of service connection of high Tension supply system

5.5 To state the relevant IE Rules and IS specification regarding the tests before giving service connections

5.6 Insulation Testing & Earth Testing

6 Underground cables **8**

6.1 To describe the types of cables and their properties.

6.2 To describe Ionisation cables

6.3 To describe the construction of Extra High voltage cables

6.4 To state the standard size of cables and their field of applications

6.4.1 To write the specification of underground cable

6.5 To describe the construction of (a) PILC Cable (b) XLPE Cable (c) PVC Cable

6.6 Describe the testing of cables (as per IS Specification)

6.7 To compare the overhead & underground Distribution system.

6.8 To describe the methods of cable laying

6.8.1 To describe the method of Cable joints for (a) PILC Cable (b) XLPE Cable (c) PVC Cable

6.8.2 To describe Cable end Boxes

6.8.3 To state the type of Tests for commissioning of cables

7 Maintenance and Repair of Transmission and Distribution Line **6**

7.1 To describe the method inspection

7.2 To describe the method of repairing of line and snapped conductor

7.3 To describe the rules for safety precautions

8	**HVDC Transmission line**	**3**
	8.1 To describe the HVDC Transmission system	
	8.2 To compare the HVDC Transmission system with HVAC Transmission system	
9	**IE Rules 1956**	**5**
	9.1 To state the IE Rules related to	
	a) Overhead lines	
	b) Conductors at different voltages on same supports	
	c) Erection of alteration to building structure, flood banks and elevation of roads	
	d) Clearance	
	e) Routes	
	f) Maximum intervals between supports	
	g) same structure carrying the Telecommunication lines	
	h) Lines crossing or approaching each other	
	i) Guarding	
	j) Service from OH Line	
	k) Earthing	
	l) Metallic bearer wire used for supporting insulated cables	
	m) Protection against lighting	
	n) Unused overhead lines	
10	Class Test	**3**

REFERENCE :

1. Power Installation (Overhead lines) by S. R. Chakravorty, Venus publishers
2. Electrical Power by S. R. Chakravorty, Venus publishers
3. IE Rules
4. Relevant B.I.S. Specifications

ELECTRICAL ENGINEERING DRAWING

L	T	P	*Curri. Ref. No.: EE 407*
0	0	6	

Total Contact hrs.: 90 ***Total marks: 100***

Theory: Nil
Practical: 90
Pre requisite:
Credit: 3

Theory:
End Term Exam: Nil
P.A.: Nil
Practical:
End Term Exam: NIL
P.A : 50

RATIONALE:

Drawing is the language of Engineers. Any job which is to be communicated for implementation is required to be done within an optimum time span and with efficacy. Since last century lot of change has taken place in Drawing for representing job specification. Standardized symbols as prescribed by Bureau of Indian specification are to be introduced while practicing the jobs on Drawing. The preparation of list of material along with the specification writing is also an important factor which is to be dealt in this subject.

AIM:

- To acquire the skill in presenting the job specification using standardised symbols used in Electro technological field (as per the stipulation by Bureau of Indian Standard).
- To acquire skill in using the norms and standards prescribed in Indian Electricity Rules and Bureau of Indian Standard regarding selection of components and circuit accessories and equipments.
- To acquire skill in preparing the list of components with full specifications.
- To acquire the skill in using handbooks and standards for developing the drawing
- To acquire the skill in presenting an object (Electrical or mechanical) through the third angle projection system.
- To acquire the skill in presenting an object (Electrical or mechanical) by free hand sketch.
- To acquire the skill in using Computer Aided Drafting for the presentation of Electrical Drawing.

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1	Construction of Assembly drawing of the Electrical& Mechanical Item	**10**
	1.1 Preparing the list of Electrical Symbols as per IS 2032 (Part I to Part XI)	
	1.2 Preparation of Drawing Sheet and selection of name plate using IS696-1972.	
	1.3 Preparation of Isometric free hand sketch of Mechanical or electrical objects and their dimensioning as per Bureau of Indian Specification	
	1.4 Preparation of orthographic projection Drawing from the free hand sketch	

2	Drawings of Joints and Electrical Accessories Preparation of Drawing on 2.1 Different type of Cable Joint 2.2 Kit Kat fuse with its holder 2.3 SPST knife switch 2.4 Carbon brush holder 2.5 Cable lugs or Thimble	**6**
3	Drawing of Electrical Instruments preparation of Drawing on 3.1 Dial of (a) Moving Iron (b) Moving Coil (c) Dynamometer and (d) Induction Type Instruments 3.2 Diagrams of deflecting systems of (a) Moving Coil (b) Moving Iron(c) Dynamometer and (d) Induction Type Instruments 3.3 Diagrams on (a) Controlling system (b) Damping System 3.4 Diagrams on (a) reed type frequency meter (b) Weston Frequency Meter 3.5 Diagram on polyphase Energy Meter	**10**
4	Drawing on Electrical Machine 4.1 Sectional Drawing of (a) D.C. Shunt Motor 4.2 Assembly Drawing of three phase wound Rotor induction Motor 4.3 Assembly Drawing of three phase transformer with tank and bushing	**10**
5	Drawing on Panels 5.1 Schematic Diagram on Automatic Star Delta starter 5.2 Control panel of a sub-station	**6**
6	Winding Diagram 6.1 Developed lap winding diagram of a 4 pole D.C. Machine 6.2 Schematic diagram of a 4 pole D.C. Machine 6.3 Developed winding diagram of double layer, short chorded lap winding of a 3 phase 400 v, 4 Pole induction Motor	**6**
7	Transmission & Distribution Line Diagram 7.1 Drawing of the diagram of a 3 phase 4 wire Power Distribution system showing the arrangements for service connection and safety device over road crossing safety guard 7.2 Diagram for HT and LT insulation with detail of fittings 7.3 Detail diagram of distribution pole with stay wire 7.4 Detail diagram of Transmission Pole with arrangement of conductors and safety devices	**6**
8	Plant and substation layout Diagram 8.1 Preparation of diagram of Pole Mounted Sub-station 8.2 Preparation of the diagram of Foundation mounted outdoor substation 8.3 Preparation of the layout of 11KV substation	**10**
9	Auto CAD version 2000 Software (a) Selecting size of paper (b) Drawing border line and name plate (c) Drawing Electronic schematic Diagram	**20**

(d) Drawing printed circuit Board
(e) Preparing printed circuit assembly drawing
(f) Mechanical Assembly drawing (usage of ELECTEMP.DRG. ELECOMP.DRG and other relevant files and commands)

N.B. The job must include Activity
Study of (a) graphic Area (b) Command Line/Prompt Area (c) Screen Menu Area (d) status line (e) pull down Menu and Menu Bar (f) Pull down Window and Dialogue Boxes (g) keyboard and function of each keys (h) Function keys (i)Hot Keys(j) usage of commands (A,C,CP,DV,E,L,LA,LT,M,MS,P,PL,PS,R,T,V,Z) (k) Input and plotting devices (l) command terminators and choice selection

10 Class Test **6**

REFERENCE:

1. Electrical Engineering Drawing by Dr. S. K. Bhattacharya, New Age International Publishers
2. I S 2032 (Part I to Part XI)
3. IS 696-1972

ELECTRICAL ENGINEERING WORKSHOP

L	T	P		
0	0	4		**Curri. Ref. No.: EE 408**
Total Contact hrs.: 60			***Total marks: 100***	**Theory:**
Theory: Nil				End Term Exam: Nil
Practical: 60				P.A.: Nil
Pre requisite:				**Practical:**
Credit: 2				End Term Exam: 50
				P.A : 50

RATIONALE:

The role of the subject Electrical Engineering Workshop is very important in building up the career of a technician. It is necessary to learn the concepts, skill, process/technique and develop attitude to work. The concept can be learned in the lecture classes, but for developing skill, learning the process or technique or to develop the attitude to work can be acquired by attending the workshop. In, this curriculum case has been taken to include such type of the job which are encountered frequently in the day to day life of an electrical technician. The jobs are arranged in such a manner that the technicians will learn the technique of solving problems and importance of the IE rules and IS specification

AIM:

a) To develop skill on wiring practices
b) To develop skill in connecting different accessories
c) To learn the techniques of fixing and preparing the layout of electrical wiring
d) To learn the techniques of measuring insulation resistance and earth resistance

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
		60

1. To identify different type of tools and accessories used in electrical work shop and prepare a list with diagram
2. To study the safety practices in Electrical workshop and prepare a brief Instructional manual
3. To dismantle a ceiling fan using screw driver, wrenches, bearing puller etc and prepare a list of components
4. To dismantle and assemble single phase and three phase pump motor using screw drivers, wrenches, bearing puller and prepare the list of components .
5. To perform the preventive maintenance operation of a three phase induction motor along with the servicing of star/delta starter and single phase preventor circuit (Maintenance schedule and maintenance log book must be prepared as per bureau of Indian Standard
6. To perform the connection of a wiring installation for (a) incandescent lamp Controlled by a reed switch (b) 5 amp. 230v. 3 pin socket controlled by a Reed switch (c) a ceiling fan controlled from a reed switch through a miniature Circuit breaker with neon indicator must be used.

7. To perform the wiring connection of twin fluorescent lamp (Stroboscopic effect elimination and power factor improvement methods must be practiced
8. To perform the wiring connection of three fluorescent lamps using three phase 4-wire supply (To state the reason and field of application of such connection
9. To assemble a Semi Automatic star Delta starter using contactors and time delay and thermal over load unit
10. Assemble a Direct on line starter using contactor, thermal over load and Single phase preventer circuit.
11. To practice the winding of coils for small transformers, and assemble it in stamping of cares finally perform the testing.
12. To perform the Megger testing of a wiring installation and fill in the test report form of the Electric Supply authorities. (The conventions stipulated in IE Rules and IS specifications must be practiced)
13. To perform the resistance measurement of an earth installation using earth Megger testing equipment (The convention stipulated in IE Rules and IS Specification must be practiced)
14. To assemble the coils of stator Rotor of an induction motor after using different type of insulating materials and locking wedges
15. Perform the testing of insulation resistance of the stator and rotor of 3 phase 400v wound rotor induction motor
16. To perform the good and bad test of (a) Diode (b) transistor (c) resistor (d) inductor (e) capacitor by digital Multimeter
17. To solder the joints of (a) 12 SWG solid copper conductor using 65 watt 230 V. soldering Iron (b) Six numbers of 10 amp. 1000 V. Diode with heat sink and connecting lugs by 35 watt 230 V. soldering iron. (c) a 8 pin DIP base on printed circuit vero board by 18 watt 230V. leakage free soldering iron using of tweeters, nippers, pliers are to be practiced. De-soldering of above job.
18. To perform the installation work of a 5 KW 400 v. motor. The work should be completed with (a) foundation detail (b) layout of the system (c) list of connection (d) testing method
19. To study and trace wiring installation of building and prepare the single layout diagram with full specification of the accessories and control gears used.
20. To practice the fixing of porcelain insulators, safety devices on the arm Steel pole (uses of the specification of Bureau of Indian Standard Specification)
21. To assemble the string insulator
22. To assemble a 400 V. Distribution panel using (a) Miniature circuit Breakers (b) MCCB (c) CT with ammeter and selecting switch (d) Voltmeter with selecting switch.

REFERENCE:

1) Electrical Installation Work by TG Francis, ELBS
2) Electrical Equipment Testing & Maintenance by AS Gill, Rusteen Publishing Company, PHC.

ELECTRONIC DEVICES AND CIRCUITS - I

L	T	P		
3	0	2		**Curri. Ref. No.: EE 409**
Total Contact hrs : 75		***Total marks: 150***	**Theory:**	
Theory: 45			End Term Exam: 70	
Practical: 30			P.A.: 30	
Pre requisite:			**Practical:**	
Credit: 4			End Term Exam:: 25	
			P.A : 25	

RATIONALE:

Electrical Engineering can not stand alone without the study of Electronic Devices & Circuits. The modern Electrical Equipments are mostly controlled by electronic circuits where both the circuits are mostly designed on the basis of linear and binary operation of the solid state devices. This subject provides the facility for the study of basic knowledge of the solid state devices and their application. Care has been taken so that the study of the practical circuits are included in this subject rather than theoretical approach. Some problems on designing of simple electronic circuits have also been included here.

AIM:

1. To develop knowledge on the characteristics of
   a) different type of diodes b) transistor
2. To describe the working principles of transistor amplifiers
3. To describe the effect of feedback on amplifier
4. To develop different application circuit on diode and transistors

DETAILED COURSE CONTENTS

Unit	Topic/Sub Topic	Hours
1	**Semiconductor Diodes**	**12**
	1.1 Semiconductor Physics	
	To describe	
	1.1.1 The properties of semiconductor	
	1.1.2 The principle of conduction in crystal	
	1.1.3 Doping	
	1.1.4 Unbiased diode	
	1.1.5 Forward and reverse biased diode	
	1.2 Characteristics and application of diodes	
	1.2.1 To describe the volt amps, characteristics of diode	
	1.2.2 To explain the property of ideal diode	
	1.2.3 To define the resistance of diode and describe the method of measurements	
	1.2.4 To describe practical diode	
	1.2.5. To state the important specifications of semiconductor diode	
	1.2.6. To describe the half wave and full wave rectifier circuits	
	1.2.7. To calculate the efficiency of rectifier circuit	
	1.2.8 To write the formulae of calculating the parameters of filter circuit	

1.2 Special purpose diodes

1.3.1 To describe the characteristics and field of application of (a) zener diode (b) capacitive diode (c) Light emitting diode (d) photo diode (e) schottky diode (f) constant current diode (g) step recovery diode (h) tunnel diode (i) PIN diode (j) gun diode.

2 Transistor **22**

3.1. To describe the construction of transistor

3.2. To describe the working principle of transistor

3.3. To state the types of transistor

3.4. To describe the characteristics of transistor and method of drawing characteristics curves

3.5. To describe the amplifying characteristics

3.6. To describe the amplifying characteristics in (a) common base (b) common emitter (c) common collector configuration

3.7. To define (a) current amplification factor (b) collector current (c) emitter current (d) leakage current (e) input resistance (f) output resistance (g) base current amplification factor

3.8. To establish the relation between α and β

3.9. To describe the method of drawing the (a) input characteristics curve (b) output characteristics curve

3.10. To compare the characteristics of three different configurations e.g. CB, CE, CC

3.11. To analyze the load line of a transistor (both for dc and ac)

3.12. To describe the function of the heat sink of a transistor.

3.13. To write the Specification of a transistor.

3.14. To state the conditions for faithful amplification.

3.15. To define transistor biasing and essential requirement of a transistor Biasing circuit.

3.16. To define the function of a small single stage amplifier,and calculate its voltage and power gain.

3.17 Classification of Amplifiers.

To define the Multistage amplifiers and different type of coupling.

To describe the different types of power amplifiers

To describe and draw the different stages of an amplifier used in PA system.

3.21 to study the feedback amplifier(concept of feedback, gain in feedback, advantage and disadvantage in feedback amplifiers).

4 Pulse Waveforms and RC networks. **3**

4.1 To study RC charging, discharging and calculations and RC frequency response.

4.2 to describe the ideal and actual rectangular waveforms with respect to rise time, fall time, duty cycle, tilt and average value.

5. Sinusoidal Oscillators: **5**

5.1 To state the type of Electronic Oscillators

5.2 To describe damped and un-damped oscillations

5.3 To state the conditions of oscillation

5.4 To study different types of oscillators like Hartley, Colpitt, Phase-shift, Wein Bridge and Crystal oscillators and their application.

6. Wave Shaping Circuits: **3**

6.1 To study the working of Diode clipping and Diode Clamping Circuits.

LIST OF EXPERIMENTS:

1. To identify the active and passive components
2. To determine the forward and reverse characteristics of PN junction diode
3. To determine the input and output characteristics of Junction transistor
4. To determine the forward and reverse characteristics of a zener diode
5. To connect the (a) common base (b) common emitter (c) common collector Amplifiers and to compare their gain
6. To assemble (a) two stage R.C. coupled (b) transformer coupled (c) Direct coupled amplifier and check the amplification of the input signal
7. To connect a single stage amplifier and check the cut off, saturation and normal biasing conditions on input signal by varying the biasing.
8. To determine the frequency response curve of a two stage R.C. coupled amplifier
9. To determine the (a) current amplification factor in common base configuration (b) base current amplification factor in common emitter configuration
10. To determine the input and output characteristics of transistor, (a) draw the D.C. load line (b) draw the collector dissipation curve
11. To construct a multistage amplifier with (a) power Amplifier and check the amplification of input signal with and without negative feedback
12. (1) Construct Hartley Oscillator and adjust (a) gain to obtain sinusoidal wave output and (b) L-C to vary the frequency (2) Determine the resonance frequency and amplitude of oscillation
13. Construct a phase shift Oscillator and adjust its gain to obtain sinusoidal output. Determine (a) gain and (b) frequency of oscillation during Oscillation
14. Construct the diode clipping and clamping circuit and observe the clipping level with change in biasing voltage
15. Construct a differentiating and integrating circuit by using R-C network.

REFERENCE:

1. Basic Electronics by S. K. Mandal, Mc Graw Hill Education
2. Electronic Principles by Sahdev, Dhanpat Rai & Sons
3. Electronic Devices and circuits by Mothershead, TMH
4. Electronic Devices by Floyd
5. Electronic Principles by Malvino, TMH

ELECTRONIC DEVICES AND CIRCUITS - II

L	T	P		
3	0	2		

Curri. Ref. No.: EE 410

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite: EE409
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
P.A.: 30
Practical:
End Term Exam:: 25
P.A : 25

RATIONALE:

The application of Electronic Devices is increasing, not only in the field of electronics communication and instrumentation but it is also used in the field of electrical Engineering. In fact the field electronics is being amalgamated with the field of Electrical Engineering. So the study of Electronic Devices and circuits are very essential for the students of the Diploma course in Electrical Engineering. The part of this subject deals with the characteristics of basic devices like diode transistors and their circuits. The second part is dealing with the special devices e.g. UJT, FET, MOSFET, OPAMP, 555 timers and three terminal regulator chips. The study of CRO, Digital Multimeter and signal generators have also been included in this subject.

AIM:

1. To acquire the knowledge of application and working principles of (a) UJT, FET, MOSFET, OPAMP, three timing regulators.
2. To acquire the knowledge for specifying and indenting of the components as stated in Sl No 1
3. To acquire knowledge on the working principles and applications of (a) CRO (both analog and Digital (b) Digital Multimeter (c) Signal generator

DETAILED COURSE CONTENT

Unit	Topic/ Sub-Topic	Hours
1.	**Uni-junction Transistor**	**6**
	1.1 To describe the construction, working principle and characteristics of Uni-junction Transistor	
	1.2 To define (a) emitter current (b) negative resistance region (c) saturation region	
	1.3. To describe the UJT relaxation Oscillator circuit and write expression for the time period of the oscillator	
	1.4 To state some application of UJT relaxation oscillator	
2.	**Field Effect transistor**	**4**
	2.1 To describe the construction, operation and characteristics of Junction Field Effect Transistor	
	2.2 To define (a) channel Ohmic region (b) Pinch off region (c) Drain resistance (d) Trans conductance	
	2.3 To describe the effect of temperature on FET parameters	

3 MOSFET (Metal Oxide Semiconductor Field Effect Transistor) 4

3.1. To describe (a) Depletion MOSFET (b) Enhancement MOSFET

3.2. To differentiate the characteristics of JFET and MOSFET

3.3. To describe (a) the handling precautions of MOSFET,

4 Opto electronic Devices 8

4.1. To describe the Electromagnetic spectrum of Light

4.2. To list the application of photo Electronic Devices

4.3. To describe the photoconductive sensors e.g.

- Bulk-type photoconductive cells
- PN photodiode
- PIN photodiode
- Avalanche Photodiode
- NPN Photodiode
- NPN Phototransistor
- Photo Darlington Transistor

4.4. To describe the applications of Photodiodes & phototransistors

4.5. To describe the function of light Emitters e.g. (a) LED's (b) Infrared Emitters (c) Laser diode

4.6. To describe the functions of (a) Photo-couplers (b) Application of the photo coupler circuit

5 Differential amplifier **4**

5.1. To define a differential amplifier and explain its significance

5.2. To describe four different configuration of the differential amplifier

5.3. To deference the voltage gain, differential input resistance and output resistance

6 Operational Amplifier **19**

6.1. To define operational amplifier

6.2. To describe the manufacturers designation for integrated circuits

6.3. To define SSI, MSI, LSI and VLSI packages

6.4. To draw the circuit symbol for a 741 Op-amp and show the pin number for each terminal

6.5. To furnish the ordering information of Op-Amp

6.6. To describe the power supplies required for Op-amp circuits

6.7. To define (a) input off set voltage (b) input off set current (c) common mode rejection ratio (d) large signal voltage gain (e) slew rate (f) output resistance (g) output short circuit current of operational amplifier

6.8. To state the seven important properties of the ideal Op-Amp

6.9. To define (a) open loop Op-Amp configuration (b) differential amplifier (c) inverting amplifier (d) non-inverting amplifier

6.10. To define (a) ground terminal (b) virtual ground

6.11. To draw the (a) inverting and non-inverting amplifier circuit

6.12. To calculate the close gain of (a) inverting and non-inverting amplifiers

6.13. To develop mathematical expression and state the applications of (a) adder (b) subtractor (c) integrator (d) differentiator circuit (e) voltage follower
6.14. To define comparator and show the output waveform for sinusoidal input and the reference voltage of (a) zero voltage (b) Positive voltage (c) negative voltage
6.15. Describe (a) zero crossing detector with hysterisis (b) voltage to current converter (c) currents to voltage converter
6.16. To state some application of Op-Amp (a) high resistance voltmeter (b) zener diode tester (c) diode tester (d) LED tester (f) 420 ma current loop (g) Tone control circuit
6.17. To explain the operation of a multi vibrator circuit and sketch its output voltage waveform and calculate the frequency of Oscillation
6.18. To develop a square/ triangular wave generation using Op-Amp, resistors and capacitor and determine frequency of oscillation
6.19. To develop basic differential amplifier using op-amp
6.20. To describe the (a) low pass (b) high pass and (c) Band pass filter

LIST OF EXPERIMENTS

1. To draw the Emitter characteristics curve of the junction Transistor and identify cutoff, negative resistance region and saturation region of the device
2. Construct a UJT Relaxation Oscillator circuit and (a) measure the peak value of (a) Curiffer voltage (b) output voltage (c) frequency of oscillation at different value of R.C.
3. To draw the (a) Drain currents for different values of V_{os} (b) Transconductance curve of JEFT
4. Construct the (a) common source (b) common drain (c) common gate amplifier of JFET and compare their gains
5. To construct the inverting amplifier and verify the gain of amplifier with various ratio of R_i and R_f. Also check the gain of input , output signals (use IC 741)
6. To construct the non – inverting amplifier and verify the gain of amplifier with various ratio of R_i and R_f . Also check the polarity of input output signals (use IC741)
7. Construct the adder and subtractor circuit using IC 741 and verify the output voltage with various input voltages
8. Construct an integrator circuit and note the output waveform for a square wave input
9. Construct a differentiation circuit and note the output wave form for a triangular input voltage.
10. To develop a comparator circuit and note the output waveform with sinusoidal input and (a) zero volt (b) positive voltage and (c) negative voltage inputs as the reference input at the non-inverting input terminals.
11. To Develop a square wave / triangular wave generator circuit by using IC 741 as square wave generator and integrator

12. To develop (a) voltage to current and (b) current to voltage converter circuit and check and adjust its linearity
13. To use a IC 741 in differential mode and check its common mode rejection capability
14. To develop an instrumentation amplifier by using three IC 741
15. To establish an astable multi vibrator circuit by using IC 555
16. To establish a Monostable multi-vibrator circuit by using IC 555
17. To develop a pulse width modulator circuit by using a 555 timer
18. To develop a regulated power supply unit using (a) step down transformer (b) Four arm bridge rectifier (c)Filter and (d) three terminal 7800 group IC regulator
19. Perform the test for different load current and input voltage and determine percent regulation
20. Develop an adjustable d.c. Voltage regulator using LM 317
21. Use a 3 ½ digit digital Multi meter for measurement of (a) D.C. voltages (B) A.C. voltages (c) frequency of a signal (d) Value of resistor (e) value of inductors (f) value of capacitor
22. Use a 3 ½ digit digital Multimeter to perform the good bad test of (a) diode (b) transistor (c) SCR.
23. Use a 3 ¾ digit digital Multimeter to measure (a) true RMS (B) Average and (c) peak value of a rectified sine wave and find its form factor and peak factor
24. Use a dual trace CRO along with a signal generator to note (a) different type of wave forms of the output of signal generator (b) The amplitude and frequency of wave form (c) phase relation between two phase shifted wave forms

REFERENCES:

1. Basic Electronics by S. K. Mandal, Mc Graw Hill Education
2. Electronic Devices and Circuits by Allen Mother Shed, PHI
3. Operational Amplifier and Linear Integrated Circuit by Robert Conghlin, Frederick F. Drescolt, PHI
4. Op-Amp and Linear Integrated Circuits by Ramakant A. Gayakwad, PHI

HEAT ENGINE

L	T	P	*Curri. Ref. No.: EE 411*
3	0	0	

Total Contact hrs.:45 ***Total marks: 100*** **Theory:**
Theory: 45 End Term Exam: 70
Pre requisite: P.A.: 30
Credit: 3

RATIONALE:

Heat Engine which is an important subject in Mechanical Engineering is also very essential for Electrical Engineering students also. This subject covers the concepts on properties of steam, steam boilers, working principles of reciprocating steam engine and steam turbine. This also covers the working principles of internal combination engine, gas turbine, and the basic principles of refrigeration system.

AIM :

- Properties of Steam
- Steam Boilers
- Reciprocating Engine
- Stream Turbine
- Condenser
- Internal Combustion Engine
- Gas Turbine

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1.0	**Properties of Steam**	**7**
	1.1 To state the difference between gas and vapor	
	1.2 To describe the phase diagram for formation of steam from ice	
	1.3 To define the following, saturated temperature and pressure, sensible heat, total heat, dry ness fraction, entropy of vapors	
	1.4 To describe the types of steam e.g., wet, dry saturated steam, superheated steam, and degree of superheat	
	1.5 To determine the dryness fraction of steam by separating and throttling calorimeters.	
	1.6 To describe non-flow process of vapors and their representation on P-V, T-S and H-S diagrams	
	1.7 To describe the flow process of vapors	
2.0	**Steam Boilers**	**5**
	2.1 To describe the functions & working principles of boilers	
	2.2 To describe the construction, mountings accessories, pressure parts and pipe fittings of modern type of boilers	
	2.3 To state the quality of boiler fuel	
	2.4 To describe the burning equipment and ash handling mechanism	

2.5 To describe the chimney draught & state its measurements
2.6 To describe the process of feed water treatment
2.7 To state the factors on which the Boiler performance is checked
2.8 To state the Boiler Acts regarding dry inspection and hydraulic tests

3.0 Reciprocating Engine **6**

3.1 To state the working principle of steam engine and its field of use
3.2 To describe the Rankine cycle
3.3 To state the types of engines
3.4 To list the components of engine and state their functions
3.5 To describe the speed governing system of steam engine
3.6 To describe the indicator diagram
3.7 To define (a) mean effective pressure (b) indicated horse power (c) brake horse power (d) Thermal efficiency (e) mechanical efficiency

4.0 Stream Turbine **8**

4.1 To describe the function and working principle of steam turbine
4.2 To state the difference between steam engine and steam turbine
4.3 To describe die functions of (a) nozzles (b) blades (c) casing (d) wheels (e) rotors (f) diaphragm and glands
4.4 To describe impulse and reaction, simple and compound, single and multistage turbine
4.5 To describe compounded impulse turbine e.g., (a) pressure compounded (b) velocity compounded (c) pressure velocity compounded
4.6 To draw the pressure and velocity diagram of all above turbines
4.7 To state and explain losses of turbine
4.8 To describe the velocity diagram of single stage impulse turbine
4.9 To calculate the work done, output and efficiency
4.10 To describe the speed governing system of the turbine
4.11 To state the possible troubles and remedies

5.0 Condenser **3**

5.1 To state the function and classification of surface and jet condensers and air pumps
5.2 To describe the effect of vacuum in condenser
5.3 To state the vacuum efficiency and condenser efficiency
5.4 To calculate the amount of cooling water required and the mixture of vapor and air
5.5 To state the source of air in condensers

6.0 Internal Combustion Engine **10**

6.1 To state the difference between internal and external combustion engine

6.2 To classify the IC engine

6.3 To describe the working principles of two stroke cycle and four stroke cycle of petrol and diesel engine

6.4 To describe the (a) cycle of operation of four stroke otto (b) diesel and dual combustion cycle (c) cycle efficiency (d) comparison between otto and diesel cycle (e) two stroke otto (f) diesel cycles (g) scavenging

6.5 To describe petrol engines, engine parts cylinder, piston, piston ring, connecting rod, crank and crank case, cam and crank-shaft

6.6 To describe carburetor of fuel, air fuel mixture, carburetors, single jet carburetors, multiple jet carburetors, choke, throtde valve gear and valve timing

6.7 To describe the ignition system e.g., coil and magnetic ignition, distributions in multi cylinder engines, effects of advancing and retarding of ignition on engine performance, compression ratio, effect of compression ratio on different fuels (ordinary petrol, doped petrol, high octane petrol, octane number)

6.8 To describe compression ignition engine e.g., dicsel engine and its parts.

6.8.1 To describe (a) fuel injection system (b) cooling system (c) exhaust system (d) governing system (e) lubricating system both for CI and SI engine

6.8.2 To describe the testing procedure of IC engines

6.8.3 To state different troubles in IC engine

6.8.4 To describe the trouble-shooting and maintenance procedure of IC engines

7.0 Gas Turbine **2**

7.1 To describe the construction and working principle of gas turbine

Class Test

REFERENCE:

1. Heat Engine by TP Mukherjee, M Dutta & Co.
2. Thermal Engineering by PL Ballaney, Khanna Publishers
3. Thermal Engineering by BK Sarkar, Tata Mc Graw Hill Publishing Company

APPLIED TECHNOLOGY COURSES

POWER ELECTRONICS

L	T	P		
3	0	2		***Curri. Ref. No.: EE 501***
Total Contact hrs.: 75			***Total marks: 150***	**Theory:**
Theory: 45				End Term Exam: 70
Practical: 30				P.A.: 30
Pre requisite:				**Practical:**
Credit: 4				End Term Exam: 25
				P.A : 25

RATIONALE:

Power Electronics is an interdisciplinary area using the members of Thyristor family control electronics to control the switch ON and switch OFF processes of the devices and principles of control theory. The filed of control electronics also had a great change from discrete and log system to the digital integrated and microprocessor control. T he area power electronics had a two sided development (a) the semiconductor devices of improved performance (b) control circuit of these devices. Thus the care has been taken to include the study of the characteristics of the power devices which are being used and also their control circuits star6ting from their rudimentary level to the block diagram study of the sophisticated computer control system.

AIM:

- To acquire knowledge in
- The characteristics of power devices like thyristor and power diodes
- Field of application of the power diode and thyristor
- The construction and working principles of speed control circuits of d.c. and a.c. machines
- The construction and working principles of a.c. power conditioners.
- The construction and working principles of inverters, switch mode power supplies and uninterrupted power supplies.

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1.	**Power Devices:** Power diode, Power Transistor, Monolithic Darlington, SCR, 5 MOSFET, GTO, IGBT, Construction, Working Principle and Characteristics	**5**
2	**Triggering Devices:** 2.1 Characteristics of SCR, Gate pulse triggering of SCR by R, RC and UJT Circuit, Isolation requirement for triggering. Isolation by pulse transformer and opt isolator. Specification and rating of thyristor, Commutation of SCR – Natural commutation and forced commutation. 2.2 Inverter circuit (single phase) using SCR and using MOSFET, PWM control of MOSFET of inverter.	**5**

3	**D.C. Regulated Power Supply:** Linear mode of operation; series, shunt, combination of two, op-amp controlled, chip version using 78XX, 79XX, LM317, LM337. Switching mode of operation; boost, buck, and combination of boost buck, forward converter and fly-back converter	**6**
4	**Power Regulation by SCR and Triac:** Half wave phase shift control of D.C. load, full wave phase shift control of D.C. load, full wave A.C. and D.C. (by phase shift); Pulsed control of D.C. shunt motor by SCR and Diac combination with back EMF as feedback element	**7**
5	**Programmable Logic Controller** Introduction to PLC, PLC instructions, Timing and Counting, Closed-loop and open-loop control using PLC	**3**
6	**Industrial Opto-electronic Devices** Industrial Light Sources, Photoconductive Cells, Photodiodes, Phototransistors, Opto-isolators, Opto-couplers, Interrupter Modules, Industrial Applications of light sensors, Bar Code and Bar Code Readers	**3**
7	**Transducers and Signal Conditioning Circuitry** Thermisters and Sensistors, Level-Sensing Transducers, Pressure and Flow-Sensing Transducers, Force-Sensing Transducers	**3**
8	**Electronic Heating: Basic Principle** Induction heating: frequency and voltage selection according to thickness and type of material, standard formulae, circuit for power supply Dielectric heating: Basic principle, frequency and voltage selection according to job, standard Formulae, circuit of power supply, precautionary measure Electric resistance, Welding: Basic principle, voltage and current selection, sequence of operation, standard circuit for sequential operation	**5**
9	**Application of Power Electronics** AC voltage regulator, single Phase & three Phase (analysis of resistive loads only), Choppers – step down, step up, Buck-boost, Inverter Types, single phase and three phase bridge (line commutation and forced commutation speed control of motors).	**5**

LIST OF EXPERIMENTS

1. To draw the characteristics curve of S.C.R.
2. To assemble the turn ON and turn OFF circuit of SCR and check the performance
3. To assemble and run push pull inverter circuit (Transistorized)
4. To assemble and run push pull inverter circuit (SCR version)
5. To assemble and control the current through DC load (360° control) by Phase Shift Method
6. To develop the circuit for current regulation through heater by phase shift Control of triac
7. To control the speed of a D.C. motor through full wave rectifier bridge and SCR (phase shift control)

8. To regulate the speed of a D.C. motor by using of zero crossing detector and UJT Oscillator
9. To regulate the speed a D.C. motor by pulsed triggering through optocoupler
10. To regulate the speed of a D.C. motor by gated pulsed triggering and Through pulsed transformer
11. To regulate the speed of an A.C. load by PWM Circuit
12. To develop the back and boost converter circuit for D.C. to D.C. conversion and check its performance
13. To run and study of a closed loop D.C. Motor control system
14. To trace the circuit of constant voltage transformer
15. To trace the circuit of a servo controlled voltage stabilizer.
16. To develop and assemble the Electro Magnetic Interference suppressor Circuits and check the performance.
17. To assemble and run the soft start method of starting of induction Motor (Wring triacs).
18. To assemble, run and check the performance of a SCR controlled Automatic Battery Charger.
19. To develop forced commutation circuits for (a) resistive load and Inductive loads.

REFERENCE:

1. Power Electronics by S. K. Mandal, Mc Graw Hill Education
2. Power Electronics by Md. H. Rashid, PHI
3. Power Electronics by Vdedam Subrahmanium, New Age International Publisher
4. Power Electronics by P.C. Sen, T.M.C.

ELECTRICAL ESTIMATING AND ILLUMINATION DESIGN

L	T	P		*Curri. Ref. No.: EE 502*
3	1	0		
Total Contact hrs.: 60		***Total marks: 100***	**Theory:**	
Theory: 60			End Term Exam: 70	
Practical: 0			P.A.: 30	
Pre requisite:			**Practical:**	
Credit: 4			End Term Exam: NIL	
			P.A : Nil	

RATIONALE:

Electrical Engineering Diploma holders are very often faces the problems of estimation of the Electrical installation work and the design aspects of the illumination system. The basic idea of electrical installations, detail of electrical components and accessories and luminaries and design procedure of illumination system is discussed here. The study of bureau of Indian standard specifications are also to be discussed in this subjects

AIM :

1. To describe the steps of design procedure
2. To describe the steps of estimating procedure
3. To design the circuits of motor controllers
4. To estimate the quantity and cost of components
5. To prepare the list of components with full specification
6. To select correct size of components
7. To design and estimate the illumination system for domestic, office, street light courtyard and factors installation

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1.0	**Electrical symbols and standards**	**2**
	1.1 To state the need of electrical system	
	1.2 To prepare the list of symbols	
	1.3 To illustrate different electrical diagram	
	1.4 To state the methods of representatives for wiring diagrams	
2.0	**Lighting Installation**	**6+2**
	2.1 To calculate the following of a domestic building a) Total load of the installation b) Size of Feeder and main switches c) Number of sub circuits d) Size of sub circuit components e) Length and number of components f) Total cost of the installation	
	2.2 (a) To show the layout of the installation on building plan (b) Prepare the single line and multiline Diagram showing the size of components	

3.0 To estimate the detail connection of a service line from (6+2)
a three phase four wire over head system (3 phase 4 wire 400 V, 50Hz 20KW load)

3.1 To calculate the following for an industrial installation
- a) Total load of the installation
- b) Size of Feeder and main switches
- c) Number of three phase sub circuit
- d) Number of single phase sub circuit as per Bureau of Indian standard
- e) Size of components
- f) Length and number of components

3.2 To Prepare layout of the system

3.3 To show the single line diagram

3.4 To estimate the cost of the installation

4.0 To estimate the cost of a pole mounted substation 6
(11 KV/400 three phase 4 wire secondary 150 KVA distribution load)
- a) Show detail diagram of the accessiories mounted
- b) Prepare list of equipment with full specification
- c) Indicate the quantity and cost of components.

5.0 Automatic Starter Design 4+1
- a) To design and estimate the automatic star / Delta starter using contractors and time delay unit
- b) To show the connection Diagram
- c) Prepare list of components with full specifications
- d) Estimate the total cost

6.0 Distribution Panel Design 4+1
- a) To design and estimate distribution panel including the bus bar and metering system
- b) To prepare the detail diagram
- c) To prepare the list of equipment with detail specification
- d) To estimate the cost

7.0 Design of illumination scheme 7+1

7.1 To define the important terminologies related to illumination

7.2 To state the laws of illumination

7.3 To use the standard formulae for determining the required lumen output

7.4 To determine the number of luminaries

7.5 To state different illumination levels for different purpose

7.6 To define, state and describe different type of luminaries like fluorescent lamp, Incandescent lamp, Sodium vapour lamp etc.

7.7 To Design a practical lighting scheme for
- a) Domestic installations b) Drawing office c) courtyard lighting
- d) street lighting

8.0 Class Test 3

REFERENCE :

1. Electrical Design, Estimating and Costing by Raina and Bhattacharya, Willey
2. Electrical Installation Work by T.G. Franies, ELBS

DIGITAL ELECTRONICS & MICROPROCESSOR - I

L	T	P		*Curri. Ref. No.: EE 503*
3	0	2		
Total Contact hrs.: 75			***Total marks: 150***	**Theory:**
Theory: 45				End Term Exam: 70
Practical: 30				P.A.: 30
Pre requisite:				**Practical:**
Credit: 4				End Term Exam: 25
				P.A : 25

RATIONALE:

A lot of MSI, LSI, VLSI and Microprocessors have been developed and are being widely used in the Industrial Applications. To understand the functions of the above-mentioned chips it is required to learn the basic principles. So different topics of digital electronics have been included in this subject. As The field of Digital Electronics and Microprocessor is very vast the subject is divided into two parts. In the first part the study of fundamental principles have been included visa vis the study of combinational and sequential logic application of different IC chips have also been included here. The knowledge of digital to Analog and Analog to Digital converters are very essential for interfacing the analog to Digital System. So these topic have also been included

AIM:

- To acquire knowledge on the operation of basic building blocks e.g. AND, OR, NOT
- To develop the (a) combinational logic circuits (b) Sequential logic circuits
- To acquire knowledge on the operation of DAC and ADC modules
- To develop application circuits by using available standard IC Chips

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1	**Number system, Radix conversion and Binary Codes**	**5**
	1.1 To define (a) binary (b) bit (c) base or radix (d) Numeric coding	
	1.2 To write the generalised equation for the conversion of a number from other systems to the decimal systems	
	1.3 To convert a number from other systems to the decimal system by using the generalised equation	
	1.4 To convert(a) decimal number to binary number(b)octal to binary (c) Binary to Octal (d) Hexadecimal to Binary (e) Binary to Hexadecimal (f) Octal to Hexadecimal (g) hexadecimal to octal number	
	1.5 To classify the numeric codes	
	1.6 To define (a) Weighted code (b) BCD Code (c) Non weighted code (d) Non-error detecting code (e) Ring counter code (f) excess three code (g) gray code (h) self checking code (i) parity checking code (j) error checking code (k) simple error correcting code (l) self correcting code (m) learning code (n) alphanumeric code (o) display code (p) seven segment display (q) dot matrix display	

1.7 To perform
i) Binary addition ii) Binary subtraction
iii) Binary multiplication iv) Binary division

1.8 To perform the (a) 1's complement operation of binary number (b) binary subtraction by using 1's complement operation (c) 2's complement operation (d) binary subtraction using 2's complement

2. Digital Logic Circuit and Boolean algebra 5

2.1 To describe (a) switching circuits (b) Logic gates
(c) Symbols for logic gates (d) truth table for different type of gates

2.2 To realise exclusive-OR in terms of basic building blocks

2.3 To define universal building blocks and realisation of basic logic gates in terms of universal logic gates

2.4 To use diode, transistor, FET, MOSFET as logic gates (or switches)

2.5 To be familiarised with RTL, DTL, TTL, ECL. IIL, MOS Circuits

2.6 To define SSI, LSI, MSI, Microprocessor, Fan in, Fan out, Noise level in TTL circuits, totempol configuration

2.7 To use Boolean Algebra for the verification De-Morgan's theorem and other Boolean Functions

2.8 To describe (a) sum of product (b) NAND gate realisation (c) Product of Sum (d) NOR gate realisation

2.9 To define (a) Minterm (b) Maxterm (c) canonical

2.10 To use Karnaugh Map for simplification of Boolean equation (Karnaugh map utilising Minterms and Maxterms)

3. Combinational and arithmetic Logic Circuits 2

3.1 To develop and explain (a) Half Adder (b) Full Adder (c)Binary parallel Adder (d) Subtractor (e) Full & half subtractor (f) Adder / Subtractor in I's complement and 2's complement system (g) BCD addition and subtraction in 9's complement system (h) excess 3 adder and subtractor

3.2 To develop and explain following circuits (a) comparators (b) Encoder (c) decoder, (d) multiplexing(e) demultiplexing (f) priority encoder (g) BCD to seven segment display decoder

3.3 State the application of above circuit

4. Sequential Circuits 2

4.1 To develop and explain the following circuits
(a) Flip Flop using NAND or NOR gate (b)RS-Flip Flop (c) clocked RS Flip Flop (d) D Flip-Flop (e) Triggering of Flip- Flop (f) J-K Flip-Flop (g) T Flip-Flop (h) Master slave Flip-Flop

4.2 To state the application of the above circuits

4.3 To develop and explain following circuits
a) Asynchronous or ripple counter (b) Modulo counter(c) synchronous counter (d) Divide by N counter (e)Decade counter (f) up-down counter (g) ring counter (h) Jhonson Counter

4.4 To state the application of above counters

5. Shift Register 2

5.1 To describe the connection diagram and application of IC Shift Registers.

5.2 To develop and explain following circuits
(a) Shift Register (b) Buffer Register (c) Serial in serial out register (SISO) (d) Parallel in serial out shift Register (PISO) (e) Parallel in

Parallel out shift Register (PIPO) (f) Bi-directional shift Registers (h) Universal Shift Register

6. Digital Memories **2**

6.1 To describe the functions and applications of Digital memories like (a) RAM (b) ROM (c) PROM (d) PLA (e) FIFO (f) Magnetic core memories (g) Magnetic Surface storage devices (h) Magnetictape (i) Magnetic Disc Storage device

6.2 To describe the following operation with the help of digital circuits

a) Serial adding b) Parallel adding
c) Parallel subtracting d) Combined adder subtractor
e) Multiplication circuit f) Division circuit

7. DA and AD converter **4**

7.1 To explain the working principles of
a) D/A Converter with binary weighted register
b) D/A converter with R and 2 R resistors
c) Monolithic / hybrid D/A Converter e.g. (1) MC 1408 (2) NE/SE 5018

7.2 To describe a practical circuit for using D/A converter in instrumentation and control circuit

7.3 To explain the working principle of
a) Successive approximation A/D converters
b) Monolithic/hybrid A/D converter
c) Single and dual slope integration ADC
d) Counter and servo type ADC
e) Parallel type ADC

7.4 To describe a practical circuit for using ADC in instrumentation and control circuit

8. Popular IC Chips used in practical circuits **6**

8.1 To develop a parallel Full adder circuit using TTL chip 7483
8.2 To develop a 3 to 8 decoder circuit using 7420 chips
8.3 To set up a BCD to 7 secget Display decoder circuit
8.4 To develop a 4 digit counter system using 7490 (Decade counters)
8.5 To develop a 4 bit serial in parallel out shift register using IC 7476
8.6 To develop dive by 'N' counter using IC 7473
8.7 To develop a multiplexed display decoder cum counter by using MM 925
8.8 To design a digital system for controlling the elevator by using sequential logic

LIST OF EXPERIMENTS

A. Experiments by using Digital Trainer Kit

1. Verification of Truth Tables for AND, OR,NOT, Exclusive-OR gates
2. To develop exclusive-OR gate using basic building block
3. To develop the half adder and full adder circuit and verify the truth table
4. To connect a 4-bit parallel full adder circuit and verify the Truth Table
5. To connect four Flip Flop circuit to develop a four bit ripple counter
6. To connect a J.K. Flip Flop circuit and verify the truth table for various input of J and K

7. To connect 4 Flip Flop with "Pre" and “CLR” input terminal for developing different type of shift registers
8. To connect the 7492 counter chip to develop different module counter
9. To connect the 7490 decade counter with display decoder system for showing the counting operation
10. Connect the XOR circuit to develop parity bit checker

B. Experiments by using bread board and IC chips

1. To develop a 3 to 8 decoder circuit
2. To develop a set-reset Flip Flop by using 7400 (NAND Gate) chip
3. To develop a divide by 'N' counter by using 7473 chip
4. To develop a two digit counter by using 7490, 7448 and seven segment Display
5. Develop a 4 to 1 multiplexer circuit by using discrete chips
6. To develop a 4 digit multiplexed display counter by using MM 925 and other relevant components
7. To develop a up down counter circuit by using Flip Flops and AOI (And OR Invert) circuits
8. To connect the DAC chip MC1408 L or 0800 in the circuit to check the conversion process
9. To connect the ADC 7109 on the circuit to check the conversion process

REFERENCES :

1. Digital Electronics Principles and Applications by S. K. Mandal, Mc Graw Hill Education.
2. Digital Electronics and Microcomputers by R.K.Gaur, Dhanpur Rai
3. Fundamental Engineering by Lionard S. Bobrow, Oxford
4. Digital Principles and application by Malvino & Leach, TMH
5. Digital Electronics and Microprocessor Problems and Solution by R.P.Jain, TMH
6. Elements of Computer Science by S. Srinivasan, New Central Book Agency Pvt Ltd

DIGITAL ELECTRONICS & MICROPROCESSOR -II

L	T	P		
3	0	2		**Curri. Ref. No.: EE 504**
Total Contact hrs.: 75			***Total marks: 150***	**Theory:**
Theory: 45				End Term Exam: 70
Practical: 30				P.A.: 30
Pre requisite: EE503				**Practical:**
Credit: 4				End Term Exam: 25
				P.A : 25

RATIONAL:

Digital Electronics & Microprocessor is not a new subject. Though the progress and advancement in this area is very fast, the study of the basic principles e.g. the study of digital building blocks and 8085A system is still continuing. As the field is very vast, The whole subject is divided into two parts. The study of Microprocessor its peripheral devices, advance level microprocessor and microcontrollers are included in the second part. A lot of emphasis has been given to do some exercise on design aspects for the better understanding. A lot of lab exercises have been included for better understand of the subject.

AIM:

- To appreciate the importance of microprocessors in flexible system design
- To acquire thorough knowledge about the architecture, memory organization, instruction set, interrupt control and programming methodology of 8085A system
- To acquire thorough knowledge of using the peripheral and interfacing devices e.g. 8251, 8255, 8253, 8257, 8279
- To acquire the first hand knowledge of system design
- To acquire knowledge on fault diagnosis and maintenance of Microprocessors Based system
- To acquire knowledge on 16 Bit Microprocessor
- To acquire knowledge on 8251 Microcontroller

DETAIL COURSE CONTENT

Unit	Topic Sub-Topic	Hours
1.	**Micro Computer System and hardware**	**4**
	1.1 To describe the structure of a micro computer	
	1.2 Define (i) Programmable (ii) Memory (iii) Input/ output (iv) CPU	
	1.3 To describe the micro computer organization and the function of a micro processor	
	1.4 To describe the principle of operation of a micro-processor	
	1.5 To describe the generic architecture of a microprocessor with its functional components (e.g. registers ALU, timing & control unit and control signals)	
	1.5.1 To describe (a) various registers (general purpose register and special purpose register) (b) general	

capability of ALU (c) various control signals (d) functions of internal and external buses.

1.6 To explain with sketch various functional components of 8085A Microprocessor

2. **Memory and Memory Organization** **3**

2.1 To describe memory organization with reference to microprocessor

2.2. To define static and dynamic RAM

2.3. To compare advantages and disadvantages of static and dynamic RAMs

2.4. To describe (a) ROM, PROM, EPROM (b) important memory timing parameters (c) memory address decoding (d) various forms of storage in microprocessor

3. **Elements of Programming** **3**

3.1 To use Binary and Hexadecimal number systems

3.2 To explain (a) instruction code (b) the need for assembly language (c) role of assembler

3.3 To state the merit and demerit of instruction length

3.4 To identify the field of instruction

3.5 To differentiate execution efficiency of various types of instructions

3.6 To describe the role of flags

3.7 To explain op-code fetching modes

3.8 To describe time requirements of instructions

3.9 To identify the blocks of a flow chart

4 Instruction Set **4**

4.1 Data Transfer & Arithmetic group of Instruction of 8085 A.

4.1.1 To identify and use the data transfer and arithmetic group of instructions

4.1.2 a) to recognize the number of T states, machine cycles, addressing modes associated with each instruction (b) to describe the effect of the instruction on flags if any

4.1.3 To write small programs using these instructions.

4.2 Logical group & Branch group of Introduction for 8085 A

4.2.1 To identify and explain the logic and branch group of restriction

4.2.2. a) To recognize the number of T states, machine cycles, addressing modes associated with each instruction b)To recognize the effect of execution of instructions, on the various flags

4.2.3 To write sets of instruction to illustrate logic and branch operations

4.2.4 To explain the use of logic instruction making or resetting of individual bus

5 Interfacing of INPUT/OUTPUT Devices **5**

5.1 To decode the address assigned to an Input / Output part.

5.2 To explain the process of interfacing and I/O device with

microprocessor for a specified device address

5.3 To explain the process of interfacing non-multiplexed and multiplexed display output port with microprocessor

5.4 To compare the software/hardware overheads of interfacing multiple ports using decoders

5.5 To compare I/O mapped I/O and memory mapped I/O interfacing with microprocessor

6 Analog Signal Interfacing **5**

6.1 To explain the need of Analog Interfacing

6.2 To explain interfacing techniques of 8 bit or higher word length Digital to Analog converters (DAC) with micro-processor

6.3 To explain interfacing techniques of 8 bits or higher word length Analog to Digital Converters (ADC) with micro-processors

6.4 To explain the need and use of Opto-isolator

6.5 To explain with examples of interfacing of 8 bit ADC/DAC with microprocessor

7 Interrupts **3**

7.1 To describe basic techniques of data transfer

8 Programmable Peripheral Interface 8255 and applications **2**

11.1 To explain the internal structure of 8255A. To describe (a) the programming methodology ofthe8255A (b) method of interfacing 8255A I/O devices in simple mode (c) method of interfacing 8255A devices in hand shake technique

9 Programmable interval Timer/Counter 8253 **2**

12.1 To describe (a) the internal architecture of 8253 (b) programming technique of 8253 Timer/Counter (c)the application of 8253 timer

10 Direct Memory Access and DMA Controller 8257 **2**

13.1 To describe (a) Direct Memory Access operation (b) the internal structure of 8251(c) method of use of DMA Controller 8257

11 Programmable Keyboard and Display Interface - 8279 **2**

14.1 To describe (a) the internal structure of 8279 (b) the programming methodology of 8279 (c) the use of 8279 for keyboard and display interface

12 Microcontroller **5**

16.1 To define Microcontroller

16.2 To compare the Microcontroller 8051 with 8bit microprocessor

16.3 To describe the 8051 Microcontroller hardware

16.4 To describe (a) the Input/Output Pins, Ports and Circuits (b) external memory (c) counters and Timers (d) Serial Data Input/Output (e) Interrupts

13 16 -bit Microprocessor and Current Trends **5**

17.1 To describe basic features of 16 bit microprocessor

17.2 To describe architecture and main feature of 8086

List of Experiments:

1) To examine the 8085A training Kit, identify the microprocessor, Keyboard interface chip, Input Output Interface Chip, Programmable timer/counter chip, serial communication chip, interrupt controller chip, RAM and ROM area.
2) To move a data (a) by immediate addressing (b)from register to register (c) register to memory(d)memory to registers
3) To add two hexadecimal numbers
4) To subtract one hexadecimal number from other
5) To add five hexadecimal numbers which are stored in 5 successive memory location
6) To arrange five random hexadecimal numbers in memory locations in a sequential order (Starting from highest to lowest)
7) To divide two hexadecimal numbers and convert the result from hexadecimal to decimal value
8) (a) To develop a time delay subroutine (b) To convert 5 hexadecimal (number into its corresponding Analog Value and display it on CRO screen using the time delay subroutine as per Sl No. 8(a)
9) To convert the analog values into its corresponding digital value and display it in the address and data field
10) To develop a Programme for driving a stepper motor
11) To develop a Programme for a Running display of HELP US in Address and Data field
12) To develop a Programme for Traffic Control System
13) To develop a Programme to display the second and Minute of a clock
14) To develop a Programme to control a Coffee Vending Machine
15) To develop a Programme for the operation of a counter

REFERENCE:

1. Microprocessors and Microcontrollers Architecture, Programming and Interfacing using 8085, 8086 and 8051 by S. K. Mandal, Mc Graw Hill Education
2. Microprocessor, Architecture, Programming and Application with the 8085/8080A by Rames S.Gaonkar, PHI
3. Introduction to Microprocessor by A.P. Mathur, TMH
4. Microprocessor by Rafiquazzaman
5. Microprocessor & Microcomputer by Malvino

SWITCH GEAR AND PROTECTION

L	T	P		
3	0	0		
Total Contact hrs.: 45			***Total marks: 100***	**Theory:**
Theory: 45				End Term Exam: 70
Practical: Nil				P.A.: 30
Pre requisite:				**Practical:**
Credit: 3				End Term Exam: Nil
				P.A : Nil

Curri. Ref. No.: EE 505

RATIONALE :

Switch gear and Protection plays an important role in the Electrical power system. Since the demand of Electrical power is increasing the job of generation, transmission and Distribution of Electrical Energy is becoming very complicated. In the modern technique of efficient generation, transmission and distribution is coming of regularly. The uses of inter connected bus National power grid is increasing day by day. For the job of operation, maintenance and repair work the service of electrical technicians care very essential. In this subject lot of information are provided so that the updated knowledge can be given to the student of Diploma in Electrical Engineering.

AIM :

- To acquire the knowledge of
- The basic principles of protection of feeders, and electrical devices like transformer and Machine
- The devices used for protection circuit
- Fundamental principles of construction operation and Maintenance of circuit breakers inclusive of vacuum circuit breaker
- Testing of protective systems and switch gears

DETAILED COURSE CONTENT

Unit	Topic/Sub Topic	Hours
1	**Protective Relays**	**4**
	1.1 To describe the following	
	(a) causes of faults	
	(b) consequences of faults	
	(c) relay protection	
	(d) zones of protections	
	(e) essential qualities of protection	
	(f) primary and back up protection	
	(g) basic principle of operation of protective system	
	(h) economic considerations	
	1.2 Basic principles and components of protection	
	1.2.1 To explain methods of discrimination	
	1.2.2 To explain the method of derivation of a single-phase quantity from three phase quantities	
	1.2.3 To describe the components of protection	

1.3 Operating principles and constructional Features of Relay

1.3.1 To state (a) the classification (b) principal types of electromagnetic relays

1.3.2 Explain (a) the theory of induction relay torque (b) the theory of rely design and construction

2. Relay Application and characteristics 4

2.1 To describe the functions and operating principle of

(a) over current relays
(b) instantaneous over current relay
(c) application of time current relays
(d) time-graded protection with over current relays
(e) directional relays
(f) directional over current relays and their connections
(g) distance relays
(h) Impedance relay
(i) Ohm rely
(j) differential relays

3. Feeder Protection 6

3.1 To describe the protection and their selection

3.2 To explain the principle of over current protection in respect of

(a) non-directional time and current grading
(b) directional time and current grading
(c) over current earth fault protection
(d) directional earth fault relays
(e) Earth-fault detection in systems earth through A.C. suppression oil

3.3 To explain the principle of distance protection in respect of

(a) effect of the ratio source Impedance to line impedance (Zs / Zv)
(b) time grading of distance relays
(c) requirements of definite distance schemes
(d) fault resistance
(e) reach of distance relay
(f) scheme of distance protection
(g) distance protection by impedance relays
(I) distance protection by reactance relays
(j) MHO distance protection
(k) over loads and power sharing
(l) current and voltage connection
(m) selection of distance scheme
(n) application of three-phase system.

3.4 To explain pilot protection in respect of

(a) wire pilot protection
(b) carrier and Microwave pilot protections

3.5 Apparatus protection

3.5.1 Transformer protection

3.5.2 To describe

(a) the nature of transformer faults
(b) Faults in Auxiliary equipment
(c) winding faults

(d) overloads and external start-circuits
(e) differential protection of transformers
(f) problems encountered in differential protection of transformers.
(g) percentage or biased differential relays
(h) methods for preventing operation on Inrush currents
(I) Influence of winding connections and earthling on earth fault current
(j) star-winding with resistance earthed neutral
(k) star-winding neutral solidly earthed
(l) delta winding
(m) over current and earth-fault
(n) earth leakage protection
(o) restricted earth-fault protection
(p) Gas actuated relays
(g) transformer feeder protection

4.0 Generator Protection **3**

4.1 To describe type of generator faults e.g.
(a) stator fault
(b) Rotor fault
(c) Abnormal running conditions

4.2 To describe
(a) the stator protection systems
(b) the rotor protection systems
(c) the field feature protection
(d) unbalanced load up protection
(e) over load protection (f) prime mover protection
(g) over speed protection (h) over voltage protection

4.3 To describe the protective scheme for a direct connected generator

4.4 To describe
(a) the protection of generator transformer unit
(b) relay tripping functions

5.0 Motor protection **3**

5.1 To describe different type of motor faults

5.2 To describe the protection systems of
(a) stator
(b) Rotor
(c) over load
(d) unbalance and single phasing
(e) under – voltage
(f) Reverse phase protection
(g) loss of synchronism

6.0 Bus Zone protection **3**

6.1 To describe different type of Bus Zone faults

6.2 To explain
(a) Bus backup protection
(b) differential scheme of Bus Bar protection
(c) frame leakage protection

7. Auto re-closing **4**

7.1 To define
- (a) Operating time of protective relay
- (b) operating time of circuit breaker
- (c) dead time of circuit breaker or system
- (d) dead time of Auto re-close relay
- (e) closing impulse time of auto-re-close relay
- (f) reclaim time of auto re-close relay
- (g) re-closing time (h) Lockout of circuit breaker
- (I) lockout of auto re-close relay (j) anti-pumping
- (k) number of shots (l) spring winding Zonal
- (m) operating counter (n) counting relay

7.2 Describe the auto re-close system of
- (a) Medium voltage auto re-close
- (b) High voltage auto re-close

8 Lighting Arrestors **4**

To describe the construction and functions of the following

8.1 Ground wire
8.2 Horn gap arrestors
8.3 Pellet type oxide film arrestors
8.4 Thyrite arrestor
8.5 Auto valve arrestor
8.6 Location of the connection of lighting arrestors from transformer

9. Circuit breakers **6**

9.1 Theory of circuit interruption
9.2 To state the rating of a circuit breaker
9.3 To define the effect of re-striking voltage transients
9.4 To describe this interaction between the breaker and circuit
9.5 To classify
- (a) current dropping
- (b) duties of switch gear

9.6 To describe
- (a) automatic switch
- (b) air circuit breakers
- (c) Oil circuit breakers (single break and multi-break construction)
- (d) Air-blast circuit breaker
- (e) performance of circuit breakers and system requirements
- (f) terminal start air unit and R.R.R.V.
- (g) interruption of small inductive and capacitive currents
- (h) Modification of circuit breaker duty by shunt resistors

9.7 To state the recent developments in circuit breakers
9.8 To describe the construction and working principles of vacuums circuit breakers
9.9 Describe the testing procedure of a circuit breaker

10. Static Relays **3**

10.1 To describe the basic principle for the development of static Relay
10.2 To describe the principle of operation of
- (a) Electronic relay

(b) transductor relay
(c) Rectifier bridge relays
(d) transistor relays
(e) Hall – effect relays
(f) gauss effect relays

11. Basic static Relays used in protective schemes. 3

11.1 To describe the basic elements of a static Relay e.g.
(a) Input element
(b) Measuring element
(c) output element
(d) Feed element

11.2 To describe the working principle of over current Relays e.g.
(a) static time- current relay and time-current characteristics
(b) directional over current relays

11.3 To explain
(a) differential protection
(b) static distance protection

12 Class Test 2

REFERENCE:

1) Power system protection and switch gear by B Ravindranath E-M- chamder, New Age Ltd. Publishers
2) Switchgear and Protection by Sawhney
3) Switchgear and Protection by Dr R.S.Jha

INDUSTRIAL INSTRUMENTATION AND CONTROL

L	T	P		
3	0	2		

Curri. Ref. No.: EE 506

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
P.A.: 30
Practical: Nil
End Term Exam: 25
P.A : 25

RATIONALE:

Due to widespread automation in Industry, the study of instrumentation and control has become very essential. The aim of this course is to develop some level of specialization in students of electrical and electronics engineering as maintenance personnel in the maintenance of sophisticated instruments. Instrumentation in all fields of engineering is becoming increasingly sophisticated with the advancement in electronic techniques together with computers entering the field of data processing, where the inputs have to be much more accurate and the controllers much faster in response. This course of instrumentation and control develops an understanding of sensors, transducers, signal conditioner and suitable display; recording devices.

AIM:

To acquire knowledge on

a) The construction characteristics and method of usage of sensors and transducer
b) The interfacing technique of sensors with both analog and digital system
c) The first hand knowledge of control system with a brief study of controllers and their usage
d) The Single Conditioning and Programmable Logic Controller (PLC)

Detailed Course Contents

Unit	Topic/Sub Topic	Hour

1. OVERVIEW OF INSTRUMENTATION **3**

1.1 To list the basic elements of Instrumentation system. To define (a) Measurement, (b) Methods of measurement, (c) function of Instrument and measurement system.
1.2 Applications of measurement system.

2. TRANSDUCERS **3**

2.1 Classification of transducers
2.2 Types of errors in transducer
2.3 Selection of transducer for specific application

3. TEMPERATURE MEASUREMENT **6**

3.1 To define temperature and state the practical scales of temperature.
3.2 To states the relation between the three scales of temperature. (C,F,K)

3.3 To explain the operating principle of the different methods of temperature measurement such as (a) ntc thermistors, (b) plantium RTD, (c) type K thermocouple (d) IC temperature sensor, (e) ultrasonic temperature transducer, (f) semiconductor thermometer, (g) quartaz crystal thermometer, (h) radiation pyrometer (total radiation, infrared, optical)

4. PRESSURE MEASUREMENT 5

4.1 To describe the concepts of pressure measurement and pressure measurement device.

4.2 To explain the different methods of pressure measurement such as (a) direct pressure measurement (eg. Force summing devices, electrical pressure transducers, photoelectric transducer, piezoelectric transducer, LVDT), b) indirect pressure measurement such as load cell.

4.3 To describe the construction and explain the principle of operation of the above.

5. FORCE AND WEIGHT MEASUREMENTS 4

5.1 To define (a) force (b) weight (mass)

5.2 To describe the construction, principle and uses of strain gauge.

5.3 To define (a) gauge factor (b) Poisson ratio, (c) torque.

5.4 To describe the dynamometer method of torque measurement.

5.5 To describe the construction of (a) linear, (b) wire wound potentiometer.

5.6 To explain the principle of operation of a pontentiometer.

6. MEASUREMENT OF OTHER PHYSICAL QUANTITIES 5

6.1 Principle for the measurement of
Humidity, Sound, PH value, Liquid level, Thickness, Fluid Flow, Velocity, Acceleration

6.2 Principle of Industrial Opto-electronic Devices:
Industrial Light Sources, Photoconductive Cells, Photodiodes, Phototransistors, Opto-isolators, Opto-couplers

7. **SIGNAL CONDITIONING 4**

7.1 To describe the basic principle (a) D.C. (b) A.C. signal conditioning (c) Data Acquisition and conversion system

7.2 To describe the basic instrumentation Amplifier

7.3 To describe the block diagram of an instrumentation system

7.4 To explain the instrumentation Amplifier circuit used on Transducers Bridge

8. **CONTROL SYSTEM ENGINEERING** 7

8.1 To define Control System Engineering (emphasis on open loop and close loop system).

8.2 To define Transfer Function

8.3 To define Block diagrams and to develop block diagram from the transfer function

8.4 To define controller and types of controller

8.5 To study D.C. and A.C. position control system (Tacho-generator)

9.0	**Display and Recording Devices** 9.1 Characteristics of digital display: specification, resolution, sensitivity, accuracy 9.2 Digital display elements: alphanumeric displays, LEDs, LCDs, Display system, dot matrix system, seven segment system 9.3 Recording: chart recorders, printer, laser printers, ink jet printer	**4**
10.	Introduction Programable logic Controller (PLC).	2
11.	Class Test	2

LIST OF EXPERIMENTS: **30**

1. To study the characteristics for the displacement measurement using LVDT.
2. To study the function of opto electric transducer.
3. To study the characteristics of K type thermocouple.
4. To use linear potentiometer for displacement measurement.
5. To study the characteristics of a platinum RTD transducer.
6. To study the characteristics of ntc thermistor
7. To study the characteristics of humidity transducer.
8. To study the characteristics of PMDC tachogenerator.
9. To study the characteristics of dynamic microphone

REFERENCE:

1. Intelligent Instrumentation by George c. Barney, PHI
2. Electronic Instrumentation by H.S. Kalsi, TMH
3. Principles of Industrial Instrumentation by D. Patranabish, TMH
4. Johnson, Curtis D., *Process Control Instrumentation Technology*, John Wiley & Sons, New York.
5. Singh, S. K., *Industrial Instrumentation and Control*, 2nd ed., Tata McGraw-Hill, New Delhi.

C PROGRAMMING WITH LINUX

L	T	P
3	0	2

Curri. Ref. No.: ECE 507

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite: Nil
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
I.A.: 30
Practical:
End Term Exam: 25
I.A: 25

RATIONALE:

This course is an introduction to the C programming language. The student will learn to write programs containing the following C language features: simple data types, one-dimensional arrays, conditional and control statements, and functions. The student will also develop programs to handle sequential files. The programs will be run on a LINUX machine, and the student will learn the necessary LINUX commands to create, edit, save, compile, link, debug and run these programs in a LINUX environment. The use of structured programming techniques, program readability, program documentation and testing will be emphasized.

AIM:

Upon completion of" this course, the successful student will be able to :

- State the basic operations of a modern digital computer and its peripherals.
- Use LINUX operating system commands to handle files, and perform programming tasks as a user.
- Use integer and real number arithmetic operations in a C program.
- Apply the concepts of variables, constants, and built-in functions in a program.
- Concept of data structure — string, array (linear, nonlinear), graph, queue, stack, tree etc.
- Write user-defined functions.
- Develop pseudo-code solutions for a stated problem. Implement the solution program using the C language.
- Utilize branching and looping techniques in a program.
- Implement simple applications using the array data type in a program.
- Pass parameters to a function
- Differentiate local variables from global variables, and state the scope of a variable.
- Write programs with clear documentation.
- Test programs for proper operation.

DETAILS COURSE CONTENT

Unit	Topic/Sub Topic	Hours

1. Digital Computer Operations **2**

- Sketch a block diagram of a computer and describe the functions of each of the blocks.

- Use the following terms to describe the operation of a computer - main memory, bit, byte, word, machine code, high-level, operating system.

2. Introduction to the LINUX Operating System 5

- Describe the functions of an operating system.
- Use the following LINUX commands (plus any additional commands specified by your instructor) - passwd, vi, chmod, cat, more, Ipr, rm, tnv, cp, Is, cd, pwd, mkdir, and mail.
- Use the vi/other editor to create a C source program.
- Use the C compiler and the linker to compile and link the source program to produce an executable code.
- Describe what is meant by the following terms: file, file-name, file extension (or file type), directory, text file, machine langualge file.
- Describe the differences between a file produced by the editor, the compiler, and the linker.

3. Basic Components of a C Program 5

- Understand the basic structure of a C program and identify its 3 basic components - the program heading, the declaration section, and ihe executable section.
- Define and give examples of the following terms: reserved words, standard identifiers, identifiers, statements, and syntax diagrams.
- Write simple programs using the predefined functions scanfQ and printfQ.
- Use the following aridimetic operations: +, -, *, %, / on integer variables.
- Use the following arithmetic operations: +, -, *, %, / on real variables.
- Use mixed-mode arithmetic expressions containing both real and integer operations.

4. Variables, Constants, and Standard Functions 4

- Understand the difference between the allocation of memory locations (in the declaration section) and the assignment of values to variables and constants.
- Use the following data types: mt, float, and char in simple programs.
- Use constants in simple programs.
- Use the scanfQ and getcharQ functions to enter data values interactively for a program.
- Use standard functions in simple programs.

Functions without Parameters' 3

- Understand the concept of a user defined function.
- Write simple programs using functions that do not use parameters.

Programming Techniques 8

- Define and give examples of pscudo-codc and algorithms.
- List the steps in the program development process.
- Write programs that have adequate documentation.
- Differentiate between compile-time errors, run-time errors and design errors.
- Given a program containing compile-time errors, (syntax errors), identify and correct the errors.
- Given a program printout containing a run-time error message, correct the error.
- Given a printout containing a design error, correct the error.
- Use the echo-checking technique to debug a program.

Decisions **3**

- Understand and use "boolean1 data types (Mcro and non-zero) as implemented m
- C.
- Construct Boolean expressions using the six relational operators and the three logical operators
- Understand operators and use the IF statement.
- Understand and use the IF ... ELSE statement.

Repetitions **4**

- Understand and correctly use the FOR.... statement in programs requiring single fixed repetition loops.
- Use nested FOR.... statements in programs requiring multiple repetitions of single repetition loops.

Testing Loops **4**

- Understand and correctly use the WHILE.... pre-test loop.
- Understand and correctly use the DO...WHILE post test loop.
- Understand and correctly use die 'coin' built-in function and correctly use it in both die WHILE and DO ... WHILE loops.

One dimensional Arrays **2**

- Understand the concept one and two dimensional arrays.
- Correctly declare an array with a variable definition.
- Write a simple input/output routine using arrays.

Functions **3**

- Understand how parameters arc passed between functions.
- Describe graphically the difference between passing parameters by value and by reference.
- Describe die difference between formal and actual parameters.
- Use functions requiring value parameters.

Scope of Variables **2**

- Describe the difference between a local and a global variable.
- Indicate the scope of each identifier for a given program.

LIST OF EXPERIMENTS:

1. Write a program to output the following multiplication table:

   7 x 1 = 7
   7 x 2 = 14
   7 x 3 = 21
   …
   …
   …
   7 x 25 = 175
2. Write a programme to calculate the average of a set of N numbers.
3. Write a program to determine and print the sum of the following harmonic series for a given value of n:

$$1+\frac{1}{2}+\frac{1}{3}+\ldots\ldots\ldots+\frac{1}{n}$$

The value of n should be given interactively through the terminal.

4. The total distance traveled by a vehicle in t seconds is given by distance = ut + $(at^2)/2$
   Where u is the initial velocity, (meters per second), a is the acceleration (meters per second^2). Write a program to evaluate the distance traveled at regular intervals of time, given the values of u and a. The programme should provide the flexibility ot the user to select his own time intervals and repeat the calculations for different values of u and a.
5. Write a programme to read the following numbers, round them off to the nearest integers and print out the results in integer form:
   29.72 301.21 -76.73 -46.46
6. Admission to a professional course is subject to the following conditions:
   a. Marks in Mathematics >=60
   b. Marks in Physics >=50
   c. Marks in Chemistry >=40
   d. Total in all three subjects >>200
   Total in mathematics and physics >=150
   Given the marks in the three subjects, write a programme to process the applications to list the eligible candidates.

7. Floyd's triangle is given as follows:

```
1
2  3
4  5  6
7  8  9  10
11 12 13 14 15
…
…
…
79                  91
```

   Write a programme to print the triangle and modify it to produce the following triangle

```
1
0  1
1  0  1
0  1  0  1
1  0  1  0  1
```

8 Write a programme that will read a positive integer and determine and print its binary, octal, hexadecimal equivalents. The programme should obtain the option from the user interactively.

9. Write a programme to calculate the standard deviation of a number of data stored in an array.
10. Consider two arrays A and B containing a sorted list of data items in ascending order. Write a programme to merge them into a single sorted array C that

contains every item from arrays A and B, in ascending order.

11. Write a programme which will read a string and rewrite it in the alphabetical order. For example, the word “INDIA” should be written as “ADIIN”.

12. Write a programme, using recursive functions, to evaluate

$$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots$$

TESTING & MAINTENANCE OF ELECTRICAL MACHINES / EQUIPMENTS

L	T	P		
1	0	6		

Curri. Ref. No.: EE 508

Total Contact hrs.: 105 ***Total marks: 125***

Theory: 15
Practical: 90

Pre requisite:

Credit: 4

Theory:
End Term Exam:100
P.A.: 30

Practical:
End Term Exam: 25
P.A : 25

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1.	**Repair of Electrical Machines** 1.1 List the troubles of Electrical Machines 1.2 To state the method of inspection and determination of defects in an Assembled Machine 1.3 To describe the dismantling process and determine the defects in a disassemble machine 1.4 To describe the machine assembly procedure 1.5 To describe the Endshield Repairing Procedure 1.6 To describe the ship ring and commutator repairing procedure 1.7 To describe the method of shaft repair 1.8 To describe the method of terminal and lead repair 1.9 To describe the method of rotor or armature balancing 1.10 To describe the method of winding repair 1.11 To describe the winding insulation and joining techniques 1.12 To perforce the test as per Bureau of Indian Standard 1.13 To apply binding to Rotors and armature	**10**
2.	**Transformer Repairing** 2.1 To describe the repair of low and medium rating Power Transformer 2.2 To list the factors for inspection before the repair of faults 2.3 To describe the method of inspection of core and winding 2.4 To describe the method of core repairs 2.5 To describe the method of repair, preparation and drying of windings 2.6 To describe the method of repair of tap changer 2.7 To describe the method of bushing repair 2.8 To describe the method of repair of tanks, conservators and fillings 2.9 To describe the method of transformer assembly 2.10 To describe the different testing and measurement procedure as per Bureau of Indian Standard Specification	**10**

3.	3.1 To describe the periodic maintenance of Switch Fuse Unit changeover and bus bar and different type starters 3.2 To prepare the operation and maintenance schedule of a Diesel Generating Set	**6**
4.	**Ceiling fan/Exhaust Fan** 4.1 To describe the electrical circuits of ceiling/exhaust fan 4.2 To describe the dismantling procedure of a ceiling /Exhaust fan 4.3 To state the precautions required to dismantle the ceiling/Exhaust fan 4.4 To state the method of the fault detecting procedure of the ceiling/Exhaust fan 4.5 To state the procedure for repair of the ceiling/Exhaust fan 4.6 To describe the method of testing of ceiling/Exhaust fan 4.7 To describe the process of preventive maintenance	**7**
5.	**Fluorescent Lamp/Sodium Vapour Lamp** 5.1 To draw and describe the circuit of the lamp fitting 5.2 To state the procedure for repair of the circuit 5.3 To perform the repair work and testing procedure	**5**
6.	**Electric Iron** 6.1 To describe the detail construction of the electric iron 6.2 To perform tests for fault finding & state the repairing procedure.	**5**
7.	**OTG/Oven** 7.1 To describe the detail construction of the OTG/Oven 7.2 To perform tests for fault finding and state the repairing procedure.	**8**
8.	**Water heater/Geyser** 8.1 To describe the detail construction of the Water heater / Geyser 8.2 To perform tests for fault finding & state the repairing procedure.	**8**
9.	**Vacuum Cleaner** 9.1 To describe the detail construction of the Vacuum Cleaner 9.2 To perform tests for fault finding & state the repairing procedure.	**9**
10.	**Split type/Window Air-conditioning** 10.1 To describe the detail construction of the Vacuum Cleaner 10.2 To perform tests for fault finding and state the repairing procedure.	**9**
11.	**Basic Refrigerator - Freezer Combination** 11.1 To describe the detail construction of the Refrigerator – Freezer. 11.2 To perform tests for fault finding and state the repairing procedure	**10**
12.	Class Test	3

REFERENCE:

1. Repair shop Electrician by G.Vartanov, V.Verner, V. Serebryakov, Peace Publishers, Moscow
2. Electricity for Air Conditioning & Refrigeration Technician by Edward F.Maohoney

NB : Some visit are to be arranged for observing repair procedure in Workshops and manufacturing unit

PROFESSIONAL PRACTICE I

L	T	P	*Curri. Ref. No.: EE 509*
0	0	2	

Total Contact hrs.: 30 ***Total marks: 50***

Theory:
Practical: 30

Pre requisite:

Credit: 1

Theory:
End Term Exam: NIL
P.A.: NIL

Practical:
End Term Exam: NIL
P.A : 50

Sr.	Activities	Hours
1.	Industrial / Field Visit : Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to any ONE from the list below: i) Nearby Petrol Pump (fuel, oil, product specifications) ii) Automobile Service Station (Observation of Components/ aggregates) iii) Telephone Exchange iv) Food Processing industry (Lay out and machine) v) Tea processing industry (Lay out and machine) vi) Dairy Plant / Water Treatment Plant (Lay out and machine) vii) Community health Centre (organization, modus-operandi, various activities) viii) Panchayet/ BDO office to understand swarojkar yojona / gram sarak yojona scheme / Rural electrification and Report on a particular/ specific case.	10
2.	**Guest Lecture by professional / industrial expert:** Lectures by Professional / Industrial Expert to be organized from any TWO of the following areas: i) Free and open source software ii) Software for drafting iii) Non destructive testing iv) Acoustics v) Illumination / Lighting system. vi) Common electricity rules & norms (do's and don'ts) for all vii) Automobile pollution, norms of pollution control viii) Fire Fighting / Safety Precautions and First aids. ix) Public health & Hygiene awareness x) Working around trucks – loading and unloading of engineering machineries. xi) Industrial hygiene. xii) Special purpose wiring in chemical / hazardous industries. xiii) Safe application of electrical energy in daily life. xiv) Energy and environment xv) Carbon Trading	6

3.	**Group Discussion :** The students should discuss in a group of six to eight students. Each group to perform any TWO group discussions. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested areas are - i) Sports ii) Social networking - effects & utilities iii) Current news item iv) Discipline and house keeping v) Use of plastic carry bag (social & domestic Hazard) vi) Any other common topic related to electrical field as directed by concerned teacher.	10
	Students Activities	
	The students in a group of 3 to 4 will perform ANY ONE of the following activities: i) Collect and study IS code for Engineering Drawing. ii) Specifications of Lubricants. iii) Draw orthographic projections of a given simple machine element using CAD software	

EXAMINATION SCHEME (SESSIONAL)

1. Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the third semester. Distribution of marks: Activities =20, Group Discussion = 10, field visit = 10, guest lecture attendance and report = 10

PROFESSIONAL PRACTICE II

L	T	P	*Curri. Ref. No.: EE 510*
0	0	2	

Total Contact hrs.: 30
Theory: 0
Practical: 30
Pre requisite:
Credit: 1

Total marks: 50

Theory:
End Term Exam: NIL
P.A.: NIL
Practical:
End Term Exam: NIL
P.A : 50

Sr. No.	Activities	Hours
1.	**Industrial / Field Visit :** Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to any ONE (not already visited in 3rd semester) from the list below: i) Electrical machine manufacturing industry ii) Multistoried building for power distribution iii) Load dispatch center iv) Transformer repair workshop. v) Foundry (to see furnaces and oven) vi) Food Processing industry (overall technical and other activities) vii) An industry automation in manufacturing viii) District Industries Centre (to know administrative set up, activities, various schemes etc) ix) Any loco shed x) Signaling system of a railway station xi) Any captive power plant. xii) Motor rewinding in a motor rewinding shop	6
2.	**Guest Lecture by professional / industrial expert:** Lectures by Professional / Industrial Expert to be organized from any TWO of the following areas: i) Modern concept of lighting / illumination ii) Viability of electric traction in 21st Century iii) Modern techniques in Power Generation iv) Role of power factor improvement as a tool in reducing cost of generation v) Digital metering vi) Hydro power generation vii) Functioning of Electricity regulatory Commission. viii) Introduction and application areas for MEMS (Micro Electromechanical System) ix) Interview techniques x) Free and open source software	4

	xi) Cyber crime & Cyber laws xii) Social networking – effects & utilities xiii) Ethical Hacking. xiv) Role of micro, small and medium enterprise. In Indian economy.	
3.	**Seminar :** Any one seminar on the topics suggested below: Students (Group of 4 to 5 students) have to search / collect information about the topic through literature survey/ internet search / visit and discussion with expert or concerned persons. 1. Water Supply scheme / Problems of drinking water in rural area 2. Schemes of power generation in coming five years 3. Impact of load shedding on rural population 4. Parallel computing 5. Distributed processing 6. Embedded system 7. Computer security 8. Bio – technology 9. Multimedia techniques. 10. Magnetic levitation system 11. On any topic covered upto this semester	12
4.	**Students' Activities / mini project: (any one)** i) Collect information from market regarding technical specification, identification no, their meaning, manufacturers' names and cost of electronic devices like diode, zener diode, transistors, JFET, MOSFET, IC 555, IC 741, digital ICS (All items studied upto 4th semester). Submit the report along with power point presentation. Students are encouraged to use open software ii) Collect information from market regarding specification and cost of items (at least four each) used in electrical wiring for Domestic, commercial and industrial use. They will submit individual report on the same. Students are encouraged to use open software. iii) make a market survey of all transducers available (studied in fourth semester) their specifications, manufacturers' names, cost etc. Prepare a power point presentation. Students are encouraged to use open software for such purpose.	10

EXAMINATION SCHEME (SESSIONAL)

1. Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the fourth semester. Distribution of marks: Student's activities/mini Project = 20, seminar = 10, field visit = 10, guest lecture attendance and report = 10

PROFESSIONAL PRACTICE III

L	T	P	*Curri. Ref. No.: EE 511*
0	0	3	

Total Contact hrs.: 30 ***Total marks: 50***

Theory: 0
Practical: 30
Pre requisite:
Credit: 2

Theory:
End Term Exam: NIL
P.A.: NIL
Practical:
End Term Exam: NIL
P.A : 50

Sr.	Activities	Hours
1.	Structured field visit be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visit to any ONE from the list below(Should not have completed in earlier Term):- 1. A thermal generating station 2. A hydal power generating station 3. A wind mill and/ or Hybrid power station of wind and solar 4. An electrical substation 5. A switchgear manufacturing/repair industry 6. An electrical Machine manufacturing Industry 7. A large industry to study protection problem 8. Any industry having Automation for manufacturing process 9. A transformer repair workshop 10. Industry of power electronics devices 11. Maintenance department of a large industry 12. Transmission tower project area 13. Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. 14. Any other technical field area as may be found suitable alternative to above list.	
2.	**Guest Lecture by Professional/Industry expert:** Lectures by Professional / Industrial Expert to be organized from any TWO of the following areas: 1. Modern trend in AC Machine 2. Automotive wiring & Lighting 3. Modern techniques in Power Generation 4. New trends in power electronics devices. 5. TQM 6. Recent modification in IE rule 7. Role of power factor improvement as tool in reducing the cost of generation 8. Digital metering 9. Hydro power generation	4

	10. Functioning of Electricity regulatory authority 11. Introduction and application areas of MEMS (Micro Electromechanical System) 12. Interview techniques 13. Career opportunities for diploma Engineers. 14. Cybercrime & Cyber laws 15. Social networking-effets & Utilities 16. Ethical Hacking 17. Industrial Dispute and labour laws. 18. Entrepreneurship development and opportunities 19. Role of micro, small and medium enterprises in Indian Economy Individual Report of the above lectures are to be submitted by the students.	
3.	**Seminar/Poster Presentation:** Students should either present in seminar or prepare poster on any ONE topic as suggested below(should not be already done in earlier semester): Students 9 Group of 4 to 5 students have to search/collect information about the topic through literature survey/internet search/visit and discussion with expert or concerned persons	12

EXAMINATION SCHEME (SESSIONAL)

1. Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the fourth semester. Distribution of marks: Student's activities/mini Project = 20, seminar = 10, field visit = 10, guest lecture attendance and report = 10

PROFESSIONAL PRACTICE IV

L	T	P	*Curri. Ref. No.: EE 512*
0	0	3	

Total Contact hrs.: 30 ***Total marks: 50***

Theory:
Practical: 30

Pre requisite:

Credit: 2

Theory:
End Term Exam: NIL
P.A.: NIL

Practical:
End Term Exam: NIL
P.A : 50

Sr.	Activities	Hours
1.	**Industrial / Field Visit :** Structured Field visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to any ONE from the list below (should not have completed in earlier semester): i) Multistoried building for power distribution ii) Any industry with process control and automation iii) District Industries Centre (to know administrative set up, activities, various schemes etc) iv) Railway / metro railway signaling system v) Motor rewinding in a motor rewinding shop vi) Visit warehouse / Rail yard / port and observe Material Handling Management & documentation. vii) A thermal / Hydel power generating station viii) A Wind mill and / or Hybrid power station of wind and solar ix) An electrical substation x) A switchgear manufacturing / repair industry xi) Protection system in a large industry. xii) Visit to maintenance dept of a large industry. xiii)A large industry to study protection system xiv) Industry of power electronics devices xv) Transmission tower project area xvi) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xvii) A large industry to study protection system xviii) Industry of power electronics devices xix)Transmission tower project area xx) Any contemporary industry under MSME sector to understand detail of operation and starting of a new venture. xix) Any other technical field area as may be found suitable alternative to above list.	12
2.	**Guest Lecture by professional / industrial expert:** The guest lecture (s) any three of two hours duration each from the field /industry experts, professionals or from experienced faculty members	12

	(from own department or other departments) will be encouraged) are to be arranged from the following or alike topics. A brief report to be submitted on the guest lecture by each student as a part of term work. **Group A (at least one)** i) Career opportunities for diploma engineers ii)Industrial Dispute and Labour Laws iii) Challenges in industrial working environment for diploma engineers iv) Scope for diploma electrical engineers v) Working in shop floor. vi) Opportunities in the service sector vii) Any other topic of relevance as may be deemed fit for fresh engineers as he starts his career in industry. **Group B (at least one)** i) Eco friendly air conditioning / refrigeration. ii) Modern trends in AC machine iii) Testing of switchgear iv) Biomedical instruments – working, calibration etc. v) Automobile pollution, norms of pollution control. vi) nanotechnology vii) Modern techniques in Power Generation viii) New trends in power electronics devices ix) TQM x) Recent modification in IE rules xi) standardization / ISO certification xii) Role of micro, small and mediun enterprise. In Indian economy. xiii) Entrepreneurship development and opportunities xiv) Interview techniques xv) Any topic that could not be covered in earlier semesters and having relevance to technical knowledge gathered in all semesters.	
3.	**Information search :** Information search can be done through manufacturers, catalogue, internet, magazines, books etc and a report need to be submitted. Can be done in a group of 2/3 students Topic suggested (any two)Teachers may assign work on any other cross disciplinary subjects for enrichment of knowledge outside course work of Electrical discipline) 1. Blue tooth technology 2. Artificial technology 3. Data warehousing 4. Cryptography 5. Digital signal processing 6. Bio-informatics 7. Magnetic levitation system 8. Recent development in electrically operated vehicles for mass transport	12

	9. Comparative study of metro railway in Kolkata and Delhi 10. Alternative fuel and energy options 11. Comparison of transformer companies 12. Latest trends in classification of insulating materials 13. Design consideration for dry type transformers 14. State and national statistics of power generation 15. Market survey of contactors, relays and their comparative analysis. 16. Market survey of any other electrical product which must include among other things various manufacturers, cost, specification, application areas etc.	
4.	**Group Discussion** The students should discuss in a group of six to eight students. Each group to perform any TWO group discussions. Topics and time duration of the group discussion to be decided by concerned teacher. Concerned teacher may modulate the discussion so as to make the discussion a fruitful one. At the end of each discussion each group will write a brief report on the topic as discussed in the group discussion. Some of the suggested topics are – i) Scope of outsourcing of electrical Engineering services. ii) Pollution Control iii) Rain water harvesting iv) Trends in energy conservation v) Safety in day to day life vi) Use of plastic carry bag (social & domestic Hazard) vii) Pollution control viii) Any other common topic related to electrical field as directed by concerned teacher.	14
5.	**Seminar / Poster presentation:** Students should select a topic for seminar based on recent development in Electrical Engineering fields, emerging technology etc. Concerned Teachers will guide students in selecting topic.	14

EXAMINATION SCHEME (SESSIONAL)

1. Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the sixth semester. Distribution of marks: Information search = 10, seminar = 10, Group discussion = 5, field visit = 10, guest lecture attendance and report = 15

PROFESSIONAL PRACTICE V

L	T	P		
0	0	6		

Curri. Ref. No.: EE 513

Total Contact hrs.: 90 ***Total marks: 50***

Theory:
Practical: 30
Pre requisite:
Credit: 3

Theory:
End Term Exam: NIL
P.A.: NIL
Practical:
End Term Exam: NIL
P.A : 50

COURSE CONTENT

1. Industrial visits.
   Structured industrial visits to local industries and factories and report for the same should be submitted by individual students as part of term work.

2. Information search, data collection and report writing on the topic .
   A topic relating to upcoming technology in the respective field is chosen by the students/faculty. Students are required to form groups of 4/5 gather information and write a report on the same

3. Seminar/Presentation
   The above report is converted into a ppt presentation and a seminar is delivered by the group for about 30-40 mins.

EXAMINATION SCHEME (SESSIONAL)

1. Continuous internal assessment of 50 marks is to be carried out by the teachers throughout the semester. Distribution of marks: Information search = 10, Seminar = 10, Group discussion = 5, field visit = 10, guest lecture attendance and report = 15.

ELECTIVE COURSES

COMPUTER BASED INDUSTRIAL CONTROL

L	T	P	*Curri. Ref. No.: EE 601*
3	0	2	

Total Contact hrs: 75
Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
I.A.: 30
Practical:
End Term Exam: 25
I.A: 25

RATIONALE:

There is a rapid growth of Computer Application in the field of Industrial Control. It is found that in most cases the transducers and output devices are analog in nature while for the easy control of many devices the software programming is used. The software programs are executed by digital computers. It may further be noted that the process control industries employ multi-access input and output devices, for this reason also the single processor and multiprocessor systems are used. This subject deals with the study of various features and components of computer based Industrial Control.

AIM:

To acquire the knowledge on

(a) The characteristics of basic building blocks of industrial control
(b) Fundamental principle of Digital Control
(c) Direct Digital Control
(d) Programmable Logic Control
(e) Distributed Digital Control
(f) Display System
(g) Final Control Elements
(h) Personal Computer in Real time Environment

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1	**Introduction**	**2**
	1.1 To state (a) the expectation from Automation (b) Basic function of Automatic Control (c)The history of development of Industrial Control (d) About the current trend in computer control of process plants	
	1.2 Write brief notes on (a) Central Computer Control System (b) Distributed Control System (c) Hierarchical Control Systems (d) Process model (e) Intelligent Control	
2	**Fundamentals of Automatic Process Control**	**3**
	2.1 To explain (a) Process definition (b) Feedback Control (c) basic principles of a single control loop (d) different principles of control e.g. two position control, Multiposition control, PID control, ratio control, cascade control	
3	**Transducer**	**3**
	3.1 To state the basic requirement of transducer	

3.2 To state the classification of transducer

3.3 Describe the function of modern transducers eg silicon transducers, fibre optic transducers LVDT, Capacitance gauges, silicon displacement

3.4 Fibre optic Displacement Transducers. Thermistors, Radiation Pyrometers, Silicon Temperature Transducers, Fibre-Optic Temperature Transducers, Piezoelectric Transducers, Silicon pressure transducers, Fibre optic pressure Transducers, intelligent sensors, on-chip signal processors, different type of biosensor

4 Building Blocks of Automation System **3**

(a) Processing systems
(b) Microcomputers and Microcontrollers
(c) The transputer
(d) Multiprocessors System
(e) Local Area Networks
(f) Analog and Digital I/O Modules
(g) Timer/counter Module
(h) Display Control Module
(i) Channel Scanning
(j) Conversion to Engineering Units
(k) Data processing
(l) Distributed SCADA System
(m) Remote Terminal Units
(n) Terrestrial UHF/VHF radio with store and forward capability

5 Direct Digital Control **4**

5.1 To define Direct Digital Control

5.2 To describe the structure of Direct Digital Control

5.3 To describe the DDC software function and algorithm

5.4 To define (a) position algorithm (b) velocity algorithm (c) Integral overshoot (d) reference position (e) reset wind up (f) auto manual switching (g) Cascade control (h) ratio control (i) multivariable control (j)Computer instrumentation (k) feed forward control

6 Programmable Controllers **4**

6.1 (a) To state the advantage of PLC (b) To state the name of popular PLC manufactures

6.2 To describe the principle of operation of PLC

6.3 To describer the architecture of programmable controllers

6.4 To describe (a) Diagnostics (b) Input/Output system (c) Programming devices

6.5 To describe the programming of programmable controller

6.6 To describe (a) Ladder diagram instruction (b) Data transfer and data manipulation operation (c) Arithmetic operation (d) Flow control operation (e) Boolean Mnemonics (f) Functional Blocks (g) Data transfer operation (h) Arithmetic and logic operation (c) PID Control

6.7 To describe the software of PLC system

6.7.1 To define (a) system program (b) Application programme (c) Communication programme

6.8 To describe the application of PLC in the field of (a) Tyre manufacture (b) Tyre Curing (c) Plastic injection moulding (d) Chemical batching (e) material handling and others.

7 Distributed Digital Control **5**

7.1 To describe the concept of Dedicated Computer System

7.2 To compare the distributed vs. Centralised Computer System

7.3 To state the functional requirements of distributed process control system

7.4 To describe (a) Plant operator's requirements (b) Maintenance Engineer's requirements (c) Design/Development Engineers requirement. (d) Manager/Supervisor's Requirements (e) Distributed Control systems Evolution

7.5 To describe the System Architecture

7.6 To describe the function of the building blocks of Distributed Control System (To describe block diagram structure of a popular system) To describe the (a) Process level (b) Unit Control level (c) group control level (d) process control level (e) Operation Control level

7.7 To describe the (a) Distributed Control sub system (b) Local Field station (c) Library of functions (d) Presentation and monitoring Devices (d1) Batch sequence operation display (d2) Process upset displays (d3) control system mal function display.

7.8 To describe the communication option in Distributed Control Systems

7.9 To describe the configuration options in Distributed Control Systems

7.10 To describe the architecture of Popular Distributed Control Systems

8 Real time programming **5**

8.1 To describe the information flow mechanism in real-time systems

8.2 To describe (a) input sub-system (b) Processing sub-system (c) Output sub-system (d) Information Processing (e) Interrupts (f) real time programming

8.3 To describe (a) Multi-Tasking Principle

8.4 To describe the State Transition diagram and its components

8.5 To describe Task Management principles and its function

8.6 To describe Inter-Task Communication Systems

8.7 To describe the avail types of Real-time Programming Language

9 Personal Computer in Real Time Environment **5**

9.1 To describe the Personal Computer System and its facilities

9.2 To describe (a) P.C Bus and Signals (b) PC-AT ISA Bus Signal (c) EISA bus signals (d)Interrupts (e) PC-AT

		Interrupts (f) EISA Interrupts (g) Interrupt Controller (h)programming and interfacing 8259	
	9.3	To describe the interfacing technique of PC to outside world.	
	9.4	To describe the function of Personal Computer in Real-Time Environment	
10	**Industrial Control on Applications**		**6**
	10.1	To describe (a) Cement Manufacturing Plant(b) Water Treatment Plant	
11	**Data Acquisition System**		**2**
	11.1	To describe the aims and objective of the Data Acquisition System	
	11.2	To describe different architecture of Data Acquisition System	
	11.3	To describe the functions of the Blocks of data Acquisition system	
12	**Class Test**		**3**

List of Experiment:

1.	To work with STEP -5 Software Programme of PLC trainer based SIMATICS5-135 U (a) Study the Hardware System (b) To practice the Digital Control Software (c) To practice PID Control software	15 10
2.	To work with GENIE Data. Acquisition & Software (a)To study the Hardware System (b) To hardness hardware modules (c) To utilise the software for connecting the analog and Digital data input module for storing, retrieving displaying and Control purpose	5
3.	To work on Micro- Controller Training kit	

REFERENCE:

1. Computer Based Industrial Control by Krishna Kant, PHI

UTILIZATION OF ELECTRICAL POWER

L	T	P	*Curri. Ref. No.: EE 602*
3	0	2	

Total Contact hrs.: 75 ***Total marks: 150***

Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Theory:
End Term Exam: 70
I.A.: 30
Practical:
End Term Exam: 25
I.A : 25

RATIONALE

All service sectors namely railway, industries, offices, multinational companies always deal with the utilization of electrical energy in the following fields e.g. electrical heating, welding, illumination, students must be thoroughly acquainted with the principles of application of electrical energy in the above fields.

AIM:

To acquire knowledge on
a) Electric heating and Welding
b) Basic idea of Illumination technology
c) Dynamics of Electrical drives related to traction.
d) Starting and Braking of DC and AC motors.
e) Electrochemical Processes.

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1	**Electrical Heating**	**8**
	1.1 Advantages	
	1.2 Heating Methods	
	1.2.1 Resistance Heating	
	i) Design of Heating Element	
	ii) Radiant Heating	
	iii) Electric Arc furnace.	
	1.2.2 Induction Heating	
	1.2.3 Dielectric Heating	
	1.2.3.1 Dielectric Loss Calculate	
2	**Electric Welding**	**8**
	2.1 Electrical arc Welding	
	2.2 Types of Electrodes	
	2.3 Resistance Welding	
	2.4 Spot Welding	
3	**Illumination**	**9**

	3.1	Nature of light & Eye Sensitivity	
	3.2	Luminous flux	
	3.3	Laws of Illumination	
	3.4	Different light sources & their evaluation	
	3.5	Polar curve	
	3.6	Mean Horizontal Candle Power (M.H.C.P.)	
4.	**Electrochemical Process**		**8**
	4.1	Laws of Electrolysis	
	4.2	Electric Depositon	
	4.3	Application of Electrolysis	
	4.4	Factors affecting electrochemical Process	
5	**Electric Drives**		**10**
	5.1	Advantages	
	5.2	Types of Electric Drives	
	5.3	Factors governing selection of motors	
	5.4	Application of motors	
	5.5	Electric Traction	
	5.6	(i) Advantages	
		(ii) Supply System	
		(iii) Requirement of traction motor	
		(iv) Breaking and Control of traction motors	
6	**Class Test**		**2**

PRACTICAL :

1. Visit to different Industrial installation to study the industrial utilisation of electrical power and prepare a brief report on this.
2. One job on arc welding to be done under the supervision of the instructor.
   a. Discuss welding safety – Protection of personnel, protection of work are ventilation, fire protection
   b. Set up shielded metal arc welding equipment (SMAW) for welding on mild steel.
   c. Study of electrode specification.
   d. Make voltage current setting.
   e. Perform square butt joint flat.

REFERENCE:

1. Art and Science of Utilization of Electrical Energy by H Pratab, Dhanpat Rai & Sons.
2. Generation, Distribution & Utilization of Electrical Energy by C.L. Wadhawa, New Age International.
3. Electric Power Utilization by Taylor Longman
4. Utilization of Electrical Power, Hartles, R. J. and Sandeman, D.G., Longman Groups Ltd.

POWER PLANT ENGINEERING

L	T	P	*Curri. Ref. No.: EE 603*
3	0	2	

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Total marks: 150

Theory:
End Term Exam: 70
I.A.: 30
Practical:
End Term Exam: 25
I.A : 25

RATIONALE

The whole world is in the grip of energy crisis and the pollution manifesting itself in the spiraling cost of energy and uncomforted due to increase in pollution as well as the depletion of conventional energy resources and increasing of pollution. It is commonly accepted that the standard of living increases with increasing energy consumption per capita. Any consideration of energy requirement and supply has to take into account the increase conservation measures. A power plant is assembly of systems or subsystems to generate electricity, i.e., power with economy and requirements. The power plant itself must be useful economically and environmental friendly to the society.

AIM:

To acquire knowledge on
1. Fundamental of Power Plant
2. Non-Conventional Energy Resources and Utilization
3. Power Plant Economics and Variable Load Problem
4. Steam Power Plant
5. Steam Generator
6. Steam Turbine
7. Fuels and Combustion
8. Diesel Power Plant
9. Gas Turbine Power Plant
10. Nuclear Power Plant
11. Hydro-Electric Power Plants
12. Pollution and its Control

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1:	**Fundamental of Power Plant**	**2**
1.1	Concept of Power Plants	
1.2	Classification of Power Plants	
1.3	Energy	
1.4	Types of Energy	
1.5	Resources for Power Generation	

1.6 Present Power Position in India

2: Non-Conventional Energy Resources and Utilization 4

2.1 Energy Science
2.2 Various Energy Science
2.3 Energy Technology
2.4 Energy Technology and Energy Sciences
2.5 Law of Conservation of Energy
2.6 Energy Exploited
2.7 Energy Demand
2.8 Energy Planning
2.9 Various Sources of Energy
    2.9.1 Conventional Sources of Energy
    2.9.2 Non-Conventional Sources of Energy
2.10 Bio-Gas
    2.10.1 Aerobic and Anaerobic Bio-Conversion Process
    2.10.2 Raw Materials
    2.10.3 Properties of Bio Gas
    2.10.4 Bio Gas Plant Technology
2.11 Wind Energy
    2.11.1 Wind Machine Fundamentals
    2.11.2 Wind Power Systems
    2.11.3 Selection of Wind Mill
2.12 Solar Energy
    2.12.1 Solar Radiations
    2.12.2 Solar Thermal Power Plant
    2.12.3 Solar Energy Storage
2.13 Geo Thermal Energy
    2.13.1 Hot Springs
    2.13.2 Steam Ejection
    2.13.3 Site Selection
    2.13.4 Geothermal Power Plants
2.14. Ocean Energy
    2.14.1 Power Plants Based on Ocean Energy

3: Power Plant Economics and Variable Load Problem 4

3.1 Factor Effecting Power Plant Design
3.2 Effect of Power Plant Type on Costs
3.3 Initial Cost
3.4 Rate of Interest
3.5 Depreciation
3.6 Operational Costs
3.7 Cost of Fuels
3.8 Labour Cost
3.9 Cost of Maintenance and Repairs
    3.9.1 Cost of Stores
    3.9.2 Supervision
    3.9.3 Taxes

3.9.4 Effect of Plant Type on Rates
3.9.5 Requirements of a Tariff
3.9.3 Types of Tariffs
3.9.4 Effect of Plant Type on Fixed Elements
3.9.5 Effect of Plant Type on Customer Elements
3.9.6 Economics in Plant Selection
3.9.7 Economic of Power Generation
3.9.8 Industrial Production and Power Generational Compared
3.9.9 Load Curves
3.13 Effect of Variable Load on Power Plan Design
3.14 Effect of Variable Load on Power Plant Operation

4 : Steam Power Plant **4**
4.1 Essentials of Steam Power Plant Equipment
4.2. Characteristics of Steam Power Plant
4.3 Coal Handling
4.4 Fuel Burning Furnaces
4.5 Method of Fuel Firing
4.6 Automatic Boiler Control
4.7 Pulverized Coal
4.8 Pulverized Coal Firing
4.9 Pulverized Coal Burners
4.9.1 Water Walls
4.9.2 Ash Disposal
4.9.3 Smoke and Dust Removal
4.9.4 Types of Dust Collectors

5 : Steam Generator **3**
5.1 Types of Boilers
5.2 Cochran Boilers
5.3 Lancashire Boiler
5.4 Locomotive Boiler
5.5 Industrial Boilers
5.6 Merits and Demerits of Water Tube Boilers over Fire Tube Boilers
5.7 Requirements of a Good Boiler

6 : Steam Turbine **3**
6.1 Principle of Operation of Steam Turbine
6.2 Classification of Steam Turbine
6.3 The Simple Impulse Turbine
6.4 Compounding of Impulse Turbine
6.5 Pressure Compounded Impulse Turbine
6.8 Impulse-Reaction Turbine
6.9 Advantages of Steam Turbine over Steam Engine
6.10 Steam Turbine Capacity
6.11 Capability
6.12 Steam Turbine Governing
6.13 Steam Turbine Performance

7 : Fuels and Combustion **4**

7.1 Coal
7.2 Coal Analysis
- 7.2.1 Proximate Analysis
- 7.2.2 Ultimate Analysis
- 7.2.3 Heating Value

7.4 Coal Firing
7.5 Mechanical Stokers
7.6 Pulverized-Coal Firing

8 : Diesel Power Plant **4**

8.1 Operating Principle
8.2 Basic Types of IC Engines
- 8.2.1 Two-Stroke, Spark Ignition Gas Engines/Petrol Engines
- 8.2.2 Diesel Engines/Heavy Oil Engines
- 8.2.3 Duel Fuel Engines
- 8.2.4 High Compression Gas Engines

8.4 Advantage of Diesel Power Plant
8.5 Disadvantage of Diesel Power Plant
8.6 Application of Diesel Power Plant
8.7 General Layout of Diesel Power Plant
8.9 Fuel System of Diesel Power Plant
- 8.9.1 Air Intakes and Admission System of Diesel Power Plant
- 8.9.2 Supercharging System of Diesel Power Plant
- 8.9.3 Types of Supercharger
- 8.9.4 Advantages of Supercharging
- 8.9.5 Exhaust System of Diesel Power Plant
- 8.9.6 Cooling System of Diesel Power Plant
- 8.9.7 Open Cooling System
- 8.9.8 Natural Circulation System

9 : Gas Turbine Power Plant **4**

9.1 Classification of Gas Turbine Power Plant
- 9.1.1 Open Cycle Gas Turbine Power Plant
- 9.1.2 Closed Cycle Gas Turbine Power Plant

9.2 Elements of Gas Turbine Power Plants
- 9.2.1 Compressors
- 9.2.2 Intercoolers and Heat Exchangers
- 9.2.3 Combustion Chambers
- 9.2.4 Gas Turbines

9.3 Regeneration and Reheating
- 9.3.1 Regeneration
- 9.3.2 Reheating

9.4 Cogeneration
9.5 Auxiliary Systems
- 9.5.1 Starting Systems

9.5.2 Ignition Systems
9.5.3 Lubrication System
9.5.4 Fuel System and Controls
9.6 Control of Gas Turbines
9.7 Gas Turbine Efficiency
9.8 Operations and Maintenance Performance
9.9 Troubleshooting and Remedies
9.10 Combined Cycle Power Plants
9.11 Applications of Gas Turbine
9.12 Advantages and Disadvantages of Gas Turbine Power Plant

10 : Nuclear Power Plant **5**

10.1 The Atomic Structure
10.2 Nuclear Energy Concepts and Terms
10.2.1 Fission
10.2.2. Critical Mass
10.2.3 Alpha Radiation
10.2.4 Beta Particles
10.2.5 Gamma Particles
10.2.6 Uramium Fission
10.2.7 Half Life
10.3 Chemical and Nuclear Equations
10.4 Nuclear Fusion and Fission
10.4.1 Fusion
10.4.2 Fission
10.5 Energy From Fission and Fuel Burn Up
10.6 Radioactivity
10.7 Nuclear Reactor
10.8 Conservation Ratio
10.9 Neutron Flux
10.10 Classification of Reactors
10.11 Cost of Nuclear Power Plant
10.12 Nuclear Power Station in India
10.13 Light Water Reactor (LWR) and Heavy Water Reactor (HWR)
10.13.1 Importance of Heavy Water
10.14 Comparison of Nuclear Power Plant and Steam Power Plant
10.15 Multiplication Factor
10.16 Uranium Enrichment
10.17 Reactor Power Control
10.18 Nuclear Power Plant Economics
10.19 Safety Measures for Nuclear Power Plants

11 : Hydro-Electric Power Plants **5**

11.1 Run-Off
11.2 Hydrograph and Flow Duration Curve
11.3 The Mass Curve
11.4 Selection of Site for a Hydro-Electric Power Plant
11.5 Essential Features of a Water-Power Plant

11.6 Calculations of Water Power Plants
11.7 Classification of Hydro-Plant
11.8 Power House and Turbine Setting
    11.8.1 Advantages and Disadvantages of Underground Power-House
11.9 Prime-Movers
11.10 Specific Speed of Turbine
11.11 Draft Tubes
    11.11.1 Methods to Avoid Cavitation
    11.11.2 Types of Draft Tubes
    11.11.3 Different Types of Draft Tubes
11.12 Models and Model Testing

12 : Pollution and its Control **4**

12.1 Environment Pollution due to Energy Use
12.2 Harmful Effects of Emissions
    12.2.1 Buildings and Materials
    12.2.2 Soil, Vegetation and Animal Life
    12.2.3 Human Beings
12.3 Noise Pollution and its Control
12.4 Fossil Fuel Pollution
12.5 Pollution due to Combustion of Fuel
12.6 Pollution due to Gas Combustion
12.7 Pollution due to Solid Fuel
12.8 Air Pollution by Thermal Power Plants
12.9 Method for Pollution Control

REFERENCE:

1. Power Plant Engineering, A. K. Raja, Amit Prakash Srivastava and Manish Dwivedi
2. A Textbook of Power Plant Engineering, by R.K. Rajput.
3. Power Plant Engineering by P. K. Nag.
4. Power Plant Engineering by G. R. Nagpal

NON-CONVENTIONAL SOURCES OF ENERGY

L	T	P	*Curri. Ref. No.: EE 604*
3	0	2	

Total Contact hrs.: 75 ***Total marks: 150*** **Theory:**
Theory: 45 End Term Exam: 70
Practical: 30 I.A.: 30
Pre requisite: **Practical:**
Credit: 4 End Term Exam: 25
I.A : 25

RATIONALE:

It is an era of power crisis. The treasure of national fuel like coal and oil being empty day by day. As a solution people are running after atomic energy. But the deadly problems of nuclear radiation made this system unusable. The people are in search of alternate energy source. This subject is an humble effort for searching the alternate source of deriving energy. The power of solar energy and its application along with wind power, wave power and solar cell have been included in this subject.

AIM:

To acquire the knowledge on
1. Assessing the solar power
2. Technique on utilising the solar power
3. Considering the application of solar power
4. Assessing the wind power and wave power
5. Technique on utilising the wind and wave power
6. Considering the usage and application of wind and wave power
7. Construction and fabrication of solar cell
8. Technique on utilising solar cells

DETAILED COURSE CONTENT

Unit	Topic / sub-topic	**Hours**
1	**Solar energy**	**10**
	1.1 Solar radiation	
	1.1.1 To describe	
	(a) Global, direct and diffused radiation.	
	(b) Spectral distribution of direct solar radiation through four types of curves.	
	(c) Radiation measuring Instruments	
	(d) Data from a radiation measurement network.	
	1.2 Water and air heating application	
	1.2.1 To describe the construction and uses of water heating system through	
	(a) flat plate collector	
	(b) spiral or “sea shell” collector	
	(c) heat pipe collector	

(d) cylindrical heater / storage system

1.2.2 To describe three types of air heaters used to dry crop in lower latitude or space heating in higher latitude.

1.2.3 To describe the integration of an air collector into a heating and cooling system

1.2.4 To know some storage units

1.3 Space heating application:

To describe the utilization of air heater and thermal energy storage in space heating application.

1.4 Thermal Power and other applications (a) Head Engine (b) Large scale power Generation (c) Furnaces (d) cookers (e) refrigeration and cooling (f) Heat pumps (g) solar ponds (h) distillation (I) industrial application of process heat and transport.

1.5 Photovoltaic Technology

a) Principle of solar cells
b) Solar cells and modules
c) Applications of photovoltaic systems
d) Photovoltaic Power Generation

2 Bio-Energy and other form of Energy **10**

2.1 To define Bio-Energy

2.1.1 To describe the sources of Bio-Energy

2.1.2 To describe the renewal system of Bio-Energy

2.1.3 To describe the following processes

(a) Pyrolysis of wood
(b) Gasification of wood
(c) Producer gas preparation
(d) Briquetting
(e) Hydrolysis of wood ethanol
(f) Liquification of wood to oil
(g) Energy plantation and power programme
(h) Biological conversion

2.2 Animal Energy

2.2.1 To define the Animal Energy

2.2.2 To describe the method of utilisation of Animal Energy.

2.3 Energy from the Ocean

2.3.1 To describe the basic process of Ocean Thermal Energy Conversion (To state (a) the location of OTEC plants (b) Application of OTEC and (c) Economic Consideration)

2.3.2 To describe (a) the method of utilisation of wave Energy (b) the method of obtaining power from salinity gradients (c) utilisation of Tidal power

2.4 Hydrogen Energy

2.4.1 To describe the method of production of mass-scale hydrogen preparation

2.4.2 To describe the method of utilisation of hydrogen as

alternative Energy source.

2.4.3 To state the advantages and disadvantages of Hydrogen Energy.

3 Wind Energy **8**

3.1 To state the historical development of wind generated Electricity in the following countries (a) Denmark (b) USA (c) Russia (d) united kingdom

3.2 To enumerate the wind energy potential

3.2.1 To state the annual velocity and power duration curves.

3.2.2 To describe the windmill

3.2.3 To describe the use of wind energy as (a) power generation (b) water pumping system

3.2.4 To describe the method of wind Energy conservation, distribution and utilisation system.

4 Solar Cell **14**

4.1 Standard silicon solar cell Technology (single crystal wafers to solar cells, solar cell to solar cell modules, module construction, cell operating temperature, module durability, module circuit design, Energy accounting)

4.2 Improved silicon cell Technology

4.2.1 To explain the properties of solar grade silicon

4.2.2 To describe the method of preparation of solar sheet and specify (a) Solar sheet requirement (b) Ingot Technologies (c) Ribbon Silicon.

4.2.3 To describe the cell fabrication and Interconnection techniques.

4.3 Concentric systems

4.3.1 To describe the principle of ideal concentrators

4.3.2 To describe the principle of (a) stationary and periodically adjusted concentrator (b) tracking concentrator (c) concentrator cell design.

4.3.3 Ultra-high efficiency systems

4.3.4 To describe the basic principle for developing ultra high efficiency system (multi gap cell concepts, thermo photo voltaic conversion)

4.4 Photo Voltaic systems components and Application

4.4.1 To describe the principle of Energy storage system

4.4.2 To describe the principle of power conditioning system

4.4.3 To state the photo voltaic applications

4.5 Design of stand Alone system

4.5.1 To describe (a) the solar module performance (b) Battery Performance (performance of lead Acid Battery, Nickel cadmium Batteries) (c) Power control system (d) the method of regulation and system sizing (e) to state the application in water pumping.

4.6 Residential and Centralised Photo voltaic power systems

4.6.1 To describe the (a) detail layout of the residential systems (b) module mounting technique (c) thermal generation system (d) system configuration

4.6.2 To describe the design principle of central power plant of solar cell system (general considerations, operating modes)

4.6.3 To describe the working principle of satellite solar power stations

5 Class Test 3

REFERENCES:

1. Sun power by J.C. Mc Veigh, Pergaman press
2. Solar Cells by Martina A. Green, Prentice series in solid state physical Electronics
3. Energy Today and Tomorrow by Dr. Mahesh Dayal, Publication Division Ministry of I and B Govt. of India

HIGH VOLTAGE ENGINEERING

L	T	P	*Curri. Ref. No.: EE 605*
3	0	2	

Total Contact hrs.:75 ***Total marks: 150*** **Theory:**
Theory: 45 End Term Exam:70
Practical: 30 I.A.: 30
Pre requisite: **Practical:**
Credit: 4 End Term Exam: 25
I.A: 25

RATIONALE :

High Voltage Engineering is highly essential in the field of Electrical Power generation. Distribution and protection. As the cables, Insulators conductors and other Electrical devices are badly exposed to the high voltage and extra High Voltage circuits, the technology of learning the testing procedure and detail of construction of the testing equipment's are very important. This subject deals with the technique of high voltage generation for testing, technique of high voltage measurement, non - destructive Insulation test techniques, and the technique for over voltages and insulation co-ordination

AIM :

To acquire the knowledge in
a. Techniques for generation of high voltage for testing
b. Techniques for high voltage measurement
c. Techniques for non-destructive insulation testing
d. Techniques for over voltage and insulation Co-ordination

DETAIL COURSE CONTENT

Unit	Topic / Sub Topic	Hours
1.0	**Over view of the power generation, transmission and Distribution**	**6**
	1.1 To describe the generation and Transmission of Electrical Energy	
	1.2 To define (a) voltage stresses (b) Testing voltages.	
	1.3 To explain	
	a. Testing with power frequency voltages.	
	b. Testing with lightning impulse voltages	
	c. Testing with switching impulses	
	d. The need for high voltage D.C. sources	
2.0	**Generation of High Voltages**	**7**
	1.4 To describe the method of	
	a. Generation of Direct Voltages	
	b. Conversion of AC to DC	
	c. Electrostatic Generator	
	d. Generation of Alternating voltages	

e. Construction and working principle of testing transformer
f. Uses of services resonance circuit and its advantages
g. The uses of impulse voltage
h. Generation technique for impulse voltage
i. Operation, design & construction of impulse generators

3.0 Measurement of High Voltages **10**

3.1 To state the types of voltages to be measured and their wave shapes

3.2 To describe the measurement of (a) peak voltage by spark gap (b) state the effect of nearby earthed objects (c) state the effect of humidity (d) effect of irradiation and of polarity (e) influence of dust particles (f) effect of rod gaps

3.3 To describe the working principle of Electrostatic Voltmeters

3.4 To describe the method of high voltage measurement by ammeter in series with high resistance method

3.5 To describe the generating or rotating voltmeters

3.6 To describe the method of peak voltage measurement by (a) Chubb – Fortescue methods

3.7 To describe (a) passive rectifier circuits and voltage devides (b) crest voltmeter for AC measurement (c) two way booster circuit (d) impulse voltages (e) active or amplifying circuit of crest voltmeter, high voltage capacitor for measuring circuits (g) single capacitance units (h) Stacked capacitor Units

3.8 Voltage Dividing system and Impulse Voltage measurements

3.8.1 To describe (a) Generalised voltage generation and Measuring circuits (b) demands upon transfer characteristics of the measuring systems (c) Fundamentals for the computation of the measuring systems

3.8.2 To describe the principles of voltage dividers

3.8.3 To describe the interaction between voltage divider and measuring circuit

3.8.4 To describe the L.V. arm of the Measuring systems

4.0 Non – destructive Insulation Test Techniques **10**

4.0 To describe the method of measurement of High voltage Dielectric loss and capacitance Measurements (schearing Bridge)

4.1 To describe the function of " Wagner Earth"

4.2 To describe the method of measurement of large capacitance.

4.3 To describe the Transformer Ratio arm Bridge

4.4 To describe the method of loss Measurement on complete Equipment

4.5 To describe the Null Detector with band pass filter

4.6 To describe the partial – discharge Measurement Technique and explain the function of (a) Partial Discharge equivalent circuit (b) Partial Discharge currents (c) the partial Discharge

		measuring circuits for Apparent charge (wide Band Partial Discharge detection and narrow – band partial Discharge detection)	
	4.7	To describe the method of suppression of disturbances	
	7.8	To describe the method of calibration of PD – Detectors in a Test Arrangement	
5.0			9
	5.1	To describe the Lightning mechanism	
	5.2	To state the (a) Energy in Lightning (b) Nature of Danger	
	5.3	To describe the simulated lightning surges for testing	
	5.4	To describe the switching surge test voltage characteristics	
6.0			**3**

NB: *Visit to high voltage testing lab should be arranged (Vocational training)*

REFERENCE:

1. High Voltage Engineering Fundamentals by Kuftel, Zaengl, Pergaman Press

REPAIRING OF ELECTRICAL MACHINE & HOUSEHOLD EQUIPMENT

L	T	P	*Curri. Ref. No.: EE 606*
3	0	2	

Total Contact hrs.: 75
Theory: 45
Practical: 30
Pre requisite:
Credit: 4

Total marks: 150

Theory:
End Term Exam:70
I.A.: 30
Practical:
End Term Exam: 25
I.A : 25

RATIONALE :

It is needed that the shop floor experience on dismantling and assembly of Electrical machines and household equipments within the curriculum of Diploma in Electrical Engineering. The learning of the procedure may be possible within a few lecture classes, but the practice should also be arranged in the workshop. This subject is designed to provide the scope of acquiring knowledge both theoretically and practically.

AIM :

To acquire skill and knowledge in

a. dismantle and assemble of Electrical machines
b. like motor, transformer, switch units and starter
c. repairing techniques of the above machines
d. Repairing of Electric Iron, OTG, Electric Oven, Water Heater / Geyser, Vacuum Cleaner, Split type / Window Air-Conditioning.

DETAIL COURSE CONTENT

Unit	Topic/Sub Topic	Hour
1	**Repair of Electrical Machines**	**10**
	1.1 List the troubles of Electrical Machines	
	1.2 To state the method of inspection and determination of defects in an Assembled Machine	
	1.3 To describe the dismantling process and determine the defects in a disassemble machine	
	1.4 To describe the machine assembly procedure	
	1.5 To describe the Endshield Repairing Procedure	
	1.6 To describe the ship ring and commutator repairing procedure	
	1.7 To describe the method of shaft repair	
	1.8 To describe the method of terminal and lead repair	
	1.9 To describe the method of rotor or armature balancing	
	1.10 To describe the method of winding repair	
	1.11 To describe the winding insulation and joining techniques	
	1.12 To perforce the test as per Bureau of Indian Standard	

	1.13 To apply binding to Rotors and armature	
2	**Transformer Repairing**	**10**
	2.1 To describe the repair of low and medium rating Power Transformer	
	2.2 To list the factors for inspection before the repair of faults	
	2.3 To describe the method of inspection of core and winding	
	2.4 To describe the method of core repairs	
	2.5 To describe the method of repair, preparation and drying of windings	
	2.6 To describe the method of repair of top changer	
	2.7 To describe the method of bushing repair	
	2.8 To describe the method of repair of tanks, conservators and fillings	
	2.9 To describe the method of transformer assembly	
	2.10 To describe the different testing and measurement procedure as per Bureau of Indian Standard Specification	
3	3.1 To describe the periodic maintenance of Switch Fuse Unit changeover and bus bar and different type starters	**6**
	3.2 To prepare the operation and maintenance schedule of a Diesel Generating Set	
4	**Ceiling fan/Exhaust Fan**	**7**
	4.1 To describe the electrical circuits of ceiling/exhaust fan	
	4.2 To describe the dismantling procedure of a ceiling /Exhaust fan	
	4.3 To state the precautions required to dismantle the ceiling/Exhaust fan	
	4.4 To state the method of the fault detecting procedure of the ceiling/Exhaust fan	
	4.5 To state the procedure for repair of the ceiling/Exhaust fan	
	4.6 To describe the method of testing of ceiling/Exhaust fan	
	4.7 To describe the process of preventive maintenance	
5	**Fluorescent Lamp/Sodium Vapour Lamp**	**5**
	5.1 To draw and describe the circuit of the lamp fitting	
	5.2 To state the procedure for repair of the circuit	
	5.3 To perform the repair work and testing procedure	
6	**Electric Iron**	**5**
	6.1 To describe the detail construction of the electric iron	
	6.2 To perform tests for fault finding and state the repairing procedure.	
7	**OTG/Oven**	**8**
	7.1 To describe the detail construction of the OTG/Oven.	
	7.2 To perform tests for fault finding and state the repairing procedure.	
8	**Water heater/Geyser**	**8**
	8.1 To describe the detail construction of the Water heater / Geyser.	
	8.2 To perform tests for fault finding and state the repairing procedure.	
9	**Vacuum Cleaner**	**9**

	9.1 To describe the detail construction of the Vacuum Cleaner 9.2 To perform tests for fault finding and state the repairing procedure.	
10	**Split type/Window Air-conditioning**	**9**
	10.1 To describe the detail construction of the Vacuum Cleaner 10.2 To perform tests for fault finding and state the repairing procedure.	
11	**Basic Refrigerator - Freezer Combination**	**10**
	11.1 To describe the detail construction of the Refrigerator – Freezer. 11.2 To perform tests for fault finding and state the repairing procedure	
12.	Class Test	3

REFERENCE:

(a) Repair shop Electrician by G.Vartanov, V.Verner, V. Serebryakov, Peace Publishers, Moscow

(b) Electricity for Air Conditioning and Refrigeration Technician by Edward, F.Maohoney

NB : Some visit are to be arranged for observing repair procedure in Workshops and manufacturing unit