STUDY AND EVALUATION SCHEME FOR

1. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING
2. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING (INDUSTRIAL CONTROL)

(Effective From)

I Year

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory				Practical				Grand Total
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
3	-	-	2	-	5	1.1 Professional Communication	2.5	50	20	70	3	20	10	30	100
3	2/2	-	-	-	4	1.2 Applied Mathematics-I	2.5	50	20	70	-	-	-	-	70
3	2/2	-	2	-	6	1.3 Applied Physics	2.5	50	20	70	3	40	20	60	130
3	-	-	2	-	5	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130
-	-	8	-	-	8	1.5 Engineering Drawing	3.0	50	20	70	-	-	-	-	70
3	-	-	2	-	5	1.6 Basic Electrical Engg.	2.5	50	20	70	3	40	20	60	130
2	-			-	2	1.7 Electrical & Electronics Engineering Material	2.5	50	20	70	-	-	-	-	70
3	-	-	2	-	5	1.8 Electronics - I	2.5	50	20	70	3	60	30	90	160
-	-	-	-	8	8	1.9 Workshop Practice	--	--	--	--	4	60	30	90	90
20	2	8	10	8	48	<---------TOTAL---------->	--	400	160	560	-	260	130	390	950
Games/NCC/Social and Cultural Activity/Community Development Work + Discipline (30 + 20)															50
Aggregate															1000

NOTE:- (1) Each period will be of 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.

STUDY AND EVALUATION SCHEME FOR

1. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING
2. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING (INDUSTRIAL CONTROL)

(Effective From)

II Year

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory				Practical				Grand Total
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
						COMMON SUBJECTS									
3	1	-	-	-	4	2.1 Applied Mathematics-II	2.5	50	20	70	--	--	--	--	70
3	-	-	3	-	6	2.2 Electronics-II	2.5	50	20	70	3	40	20	60	130
4	-	-	-	4	8	2.3 Electrical Design,Drawing and Estimating-I	3.0	50	20	70	4	40	20	60	130
2	1	-	-	4/2	5	2.4 Electrical Instruments & Measurements.	2.5	50	20	70	3	40	20	60	130
3	-	-	2	-	5	2.5 Elementary Mechanical & Civil Engineering.	2.5	50	20	70	3	40	20	60	130
1	-	-	3	-	4	2.6 Computer Application For Engineering	--	--	--	--	3	60	30	90	90
						SUBJECTS FOR ELECTRICAL ENGG.									
3	1	-	4	-	8	2.7 Electrical M/c-I	2.5	50	20	70	3	40	20	60	130
3	1	-	-	-	4	2.8 Power Plant Engg.	2.5	50	20	70	-	--	--	--	70
3	1	-	-	-	4	2.9 Trans. & Distri of Elect Power	2.5	50	20	70	-	--	--	--	70
25	5	-	12	6	48	<---------TOTAL---------->	--	400	160	560	--	260	130	390	950
						SUBJECTS FOR ELECTRICAL ENGG. INDUSTRIAL CONTROL									
3	2/2	-	3	-	7	2.10 Electrical M/c	2.5	50	20	70	3	40	20	60	130
3	2/2	-	-	-	4	2.11 Generation, Transmission& Distribution of Elect power	2.5	50	20	70	-	--	--	--	70
2	2/2	-	2	-	5	2.12 Power Electronics	2.5	50	20	70	3	35	15	50	120
24	5	-	13	6	48	<---------TOTAL---------->	--	400	160	560	--	235	115	350	1000
Games/NCC/Social and Cultural Activity/Community Development Work+ Discipline (30+20)															50

TOTAL FOR ELECT. ENGG.-950+50=1000 TOTAL FOR ELECT. ENGG. (INDUST. CONTROL) --1000+50=1050

NOTE:- (1) Each period will be of 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) 4 weeks structured & supervised branch specific task oriented industry/field exposure to be organised during summer vacation.

STUDY AND EVALUATION SCHEME FOR

1. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING
2. THREE YEARS DIPLOMA COURSE IN ELECTRICAL ENGINEERING (INDUSTRIAL CONTROL)

(Effective From)

FINAL Year

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory			Practical				Grand Total
Lec.	Tutorial	Drawing	Lab	Work Shop	Total		Examination Dur.	Marks	Sess. Marks	Total Marks	Examination Dur.	Marks	Sess. Marks	Total Marks	
						Common Subjects									
2	2/2	-	-	-	3	3.1 Industrial Management and Entrepreneurship Development	2.5	50	20	70	--	--	--	--	70
2	-	-	-	4	6	3.2 Installation, Maintenance & Repair of Elect. Machines	2.5	50	20	70	3	70	35	105	175
2	2/2	-	-	-	3	3.3 Switch Gear & Protection	2.5	50	20	70	-	--	--	--	70
2	-	-	-	-	2	3.4 Environmental Education & Disaster Management	2.5	50	--	--	--	--	--	--	--
-	-	-	-	4	4	3.5 Project -i. Problem	--	--	--	--	3	100	50	150	150
						ii. Field Exposure	--	--	--	--	-	40	15	55	55
						Subjects for Electrical Engg.									
2	2/2	-	2	-	5	3.6 Industrial Elex. & Control	2.5	50	20	70	3	70	35	105	175
2	2/2	-	-	8	11	3.7 Electrical Design,Drawing & Estimating II	3.0	100	40	140	-	--	--	---	140
2	2/2	-	-	-	3	3.8 Utilisation of Elect. Energy	2.5	50	20	70	-	--	--	---	70
2	2/2	-	4	-	7	3.9 Electrical Machine II	2.5	50	20	70	3	70	35	105	175
3	2/2		-	-	4	3.10ELECTIVE (Any One)	2.5	50	20	70	-	--	--	--	70
						a. Control of Electrical Machine									
						b. Process Control Instrumentation									
						c. Electric Traction									
						d. Renewable Sources of Energy									
						e. High Voltage Engineering									
						f. Energy Management									
19	7	-	6	16	48	<---------TOTAL---------->	--	450	180	630	--	350	170	520	1150
						Games/NCC/Social and Cultural Activity/Community Development Work+ Discipline (30+20)									50
						Subjects for Electrical Engg.(Industrial Control)									
3	2/2	-	4	-	8	3.11 Industrial Control I	2.5	50	20	70	3	60	30	90	160
3	1	-	-	-	4	3.12 Industrial Control II	2.5	50	20	70	-	--	--	--	70
2	2/2	-	-	-	3	3.13 Control System & Process Application	2.5	50	20	70	-	--	--	--	70
2	2/2	-	4	-	7	3.14 Micro processor Develop. Systems	2.5	50	20	70	3	40	25	65	135
3	2/2	-	4	-	8	3.15 Electrical & Electronics Instrumentation	2.5	50	20	70	3	60	30	90	160
21	7	-	12	8	48	<-------Total ------------->	-	400	160	560	-	370	185	555	1115
						Games/NCC/Social and Cultural Activity/Community Development Work+ Discipline (30+20)									50

Total Marks for Electrical Engg.

	III Yr	1200
30 % Carry Over of	I Yr	300
70 % Carry Over of	II Yr	700
	Total	2200

Total Marks for Electrical Engg.(Industrial Control)

	III Yr	1165
30 % Carry Over of	I Yr	300
70 % Carry Over of	II Yr	735
	Total	2200

NOTE:-
(1) Each period will be of 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) Field visit and extension lectures are to be organised and managed well in advance at institute level as per need.
(6) Field exposure will be treated as the part of project 40 marks will awarded on the basis of field exposure report and viva by project examiner.
(7) The exology and environment awareness (4 extension lectures).
(8) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

CONTENTS

MAIN FEATURES OF THE CURRICULUM

Title of the course :	1. Diploma in Electrical Engg. 2. Diploma in Electrical Engg.(Industrial Control)
Duration	Three Years
Pattern of the course	Annual System
Intake	30
Type of course	Full Time
Entry qualification	10+ with science & mathematics (Not Elementary)
Mode of admission	Through Joint Entrance Examination

LIST OF EXPERTS

List of experts who contributed in the revision of curriculum for three years diploma course in electrical engineering.

1. Dr. Ravindra Arora
   Prof. Electrical Engg.
   I.I.T. Kanpur.

2. Dr C.P.Gupta
   Prof.Electrical Engg. Department(Retd.)
   Motilal Nehru Regional Engineering College
   Allahabad

3. Dr K.K.Ghosh
   Prof.& Head Electrical Engg. Department
   H.B.T.I.Kanpur

4. Sri D.R. Nagpal
   Dy. General Manager,
   Ordinance Factory, Kanpur.

5. Sri V.N. Pandey
   Principal,
   Lucknow Poly., Lucknow.

6. Sri B.Lal
   Asstt. Professor
   Institute of Research Development & Training
   U.P.Kanpur

7. Sri B.B.Kishore
   Principal
   Janta Polytechnic Jahangirabad U.P.

8. Sri S.K.Malviya
   Head,Electrical Engg.
   Govt. Polytechnic Jhansi

9. Sri C.L. Katiyar
   Head of Electrical Engg.
   Govt. Poly. Kanpur.

10. Sri R.S.K. Sinha
    Asstt. Prof.
    B.T.E. Lucknow.

11. Sri U.B. Singh
    Lecturer Electrical Engg.
    Govt. Poly. Lucknow.

12. Sri Yashbir Singh
    Lecturer,Electrical Engg.
    Govt. Polytechnic Kanpur

13. Sri A.M. Sahai
Lecturer,Electrical Engg.
Govt. Polytechnic Kanpur

14. Sri J.P. Yadav
Dy. Director
Institute of Research Development & Training
U.P.Kanpur

15. Sri M.R. Khurana
Asstt. Professor
Institute of Research Development & Training
U.P.Kanpur

16. Sri Ashraf Ali
Lecturer,
Institute of Research Development & Training
U.P.Kanpur

WORKSHOP PRACTICE

1. Sri R.K.Gurtu
Principal
Govt. Polytechnic Lucknow

2. Sri Jameel Ahmad
Principal
Feroze Gandhi Polytechnic Raibareli

3. Sri Gopi Chandra
Workshop Superintendent
Govt. Girls Polytechnic Lucknow

4. Sri Ram Murti Bajpai
Workshop Superintendent
Govt. Polytechnic Lucknow

5. Sri H.K.Bhatnagar
Workshop Superintendent
Lucknow Polytechnic Lucknow

6. Sri Anul Hassan
Workshop Superintendent
Govt. Polytechnic Lucknow

7. Sri K.N.Gupta
Lecturer Mechanical Engg.
Govt. Polytechnic Lucknow

BASIC SCIENCES

1. Sri C.K.Misra
Lecturer,Physics
Govt. Polytechnic Kanpur

2. Sri P.K.Gupta
Lecturer,Physics
Govt. Polytechnic Barabanki

3. Sri P.K.Tewari
Lecturer,Physics
Lucknow Polytechnic Lucknow

4. Sri R.B.Srivastava
Lecturer,Physics
Sanjay Gandhi Polytechnic,Jagdishpur

5. Smt. Nisha Bahuguna
Lecturer,Physics
Govt. Girls Polytechnic, Lucknow

6. Sri P.C.Dikshit
Lecturer,Chemistry
Govt. Girls Polytechnic, Luckow

7. Sri H.S.Sharma
Lecturer,Chemistry
Govt. Polytechnic, Lucknow

8. Smt Indu Srivastava
Lecturer,Chemistry
Sanjay Gandhi Polytechnic, Jagdishpur

9. Sri S.G.Mahendra
Lecturer,Chemistry
Lucknow Polytechnic, Lucknow

10. Sri J.P.Mishra
Lecturer,Mathematics
Govt. Polytechnic, Kanpur

11. Sri M.P.Singh
Lecturer,Maths
Govt. Polytechnic, Lucknow

12. Sri G.Singh
Lecturer,Maths
Sanjay Gandhi Polytechnic, Jagdishpur

13. Sri O.P.Syal
Lecturer,Maths
Lucknow Polytechnic, Lucknow

The curriculum as developed was reviewed by the following members of the committee (constituted as per G.O. No. 1979/91-Pra Shi-3-236(B)/91 dated 3 June 1991.)

1. Shri L.N. Misra
Joint Secretary

U.P.Govt.
Lucknow.

2. Prof. K. B. Naik
Professor & Head Elect. Engg. Deptt.
Kamla Nehru Institute of Technology
Sultanpur.

3. Shri P.C. Dikshit
Director,
I.R.D.T., Kanpur.

4. Shri B.K. Sharma
Superintending Engineer (H. Q.)
K.E.S.A. Kanpur.

5. Shri A.D. Nagia
General Manager (Works)
Som Electromechanical Industries Ltd.
Industrial Estate, Panki, Kanpur.

6. Shri D.S. Ikhar
Manager, B.H.E.L.
Jhansi.

7. Smt. Sushma Gaur
Asstt. Professor
B.T.E., U.P.,
Lucknow.

8. Shri S.K. Malviya
Head,Elect.Engg.
Govt. Polytechnic
Jhansi.

The members of the committee recommended its being adopted after a few ammendments which have been incorporated in the curriculum.

LIST OF EXPERTS

List of experts who contributed in the revision of curriculum Under Semester System for 6 semester diploma course in electrical engineering & Electrical Engineering(Industrial Control) held on April 19,1999.

1. Smt. Usha Birjee
   Director
   Institute of Research Development & Training
   Kanpur.
2. Sri A.K.Srivastava
   Directorate of Technical Education
   Kanpur.
3. Sri S.C.Gupta
   ASSTT.Director
4. Sri S.K.Malviya
   Asstt.Director
   Directorate of Technical Education
   Kanpur.
5. Sri J.P.Yadav
   Dy.Director
   Institute of Research Development & Training
   U.P.Kanpur
6. Sri P.k.Sachdeva
   Lecturer,Electrical Engg.
   Govt. Polytechnic Kanpur
7. Sri C.L. Katiyar
   Head of Electrical Engg.
   Govt. Poly. Kanpur.
8. Sri K.M.Gupta
   Asstt. Prof.
   Institute of Research Development & Training
   U.P.Kanpur
9. Sri M.P.Singh
   Asstt. Prof.
   Institute of Research Development & Training
   U.P.Kanpur
10. Sri Ashraf Ali
    Professor
    Institute of Research Development & Training
    U.P.Kanpur

The working professional who contributed in the revision of curriculum in semester system are also as following

1. Sri D. K. Agrawal
   Asstt. Work Manager, Small Arms Factory, Kanpur

2. Sri N. K. Sharma
Junior Works Manager, Field Gun Factory, Kanpur

3. Sri P. L. Kalra
Junior Works Manager, Ordinance Parachute Factory, Kanpur

LIST OF EXPERTS

List of experts who contributed in the revision of curriculum diploma course in electrical engineering & Electrical Engineering(Industrial Control). in Annual System Jan. 2001 at H. B. T. I., Kanpur.

1. Dr. K.K.Ghosh
Professor Electrical Engg.
H. B. T. I., Kanpur.
2. Dr. K.K.Tripathi
Professor Electronics Engg.
H. B. T. I., Kanpur.
3. Dr. K. A. Misra
Professor Electrical Engg.
H. B. T. I., Kanpur.
4. Sri Bal Gopal
Professor Electronics Engg.
H. B. T. I., Kanpur.
5. Sri A.P. Singh
Lecturer,Electrical Engg.
Institute of Research Development & Training
U.P.Kanpur
7. Sri Yasveer Singh
Text Book Officer
Institute of Research Development & Training
U.P.Kanpur

List of experts who contributed in the revision of curriculum diploma course in Electrical Engineering (Industrial Control). in Annual System 29-9-04, 28-1-05 at I. R. D. T., Kanpur.

1.	Sri G. S. Misra	Director	ETI, Lucknow
2.	Smt. Anjana Rani.	Dy. Manager	UPTRON,Lucknow
3.	Sri M. D. Advani	HOD(Elect),Retd.	G. P. Kanpur
4.	Sri S. P. Srivastava	HOD(Elect)	G.P.,Barilley
5.	Sri Dharmendar Singh	HOD(Computer	G.G.P.,Allahabad
6.	Sri S. K. Singh	HOD(IC)	G. P.,Rampur
7.	Sri P. K. Sachdiva	Lecturer	G. P., Kanpur
8.	Sri A. P. Singh	Lectruer	G. P., Kanpur
9.	Sri V. Arya	Lecturer	D.M.Poly.,Meerut
10.	Sri S. Prasad	Lecturer	G.P.,Shajhanpur
11.	Sri I. Ahamad	Lecturer	G.P., Baharaich
4.	Sri K. M. Gupta	Asstt. Prof.	I. R.D.T.,Kanpur
5.	Sri Yashveer Singh	T.B.O.	I. R.D.T.,Kanpur
6.	Mohd. Sabir	Head	G.P.,Mainpuari
7.	Sri Ashraf Ali	Professor	I. R.D.T.,Kanpur
8.	Smt. R. P. Alam	Asstt. Prof.	I. R.D.T.,Kanpur
9.	Smt. Anita Bajpai	Asstt. Prof.	I. R.D.T.,Kanpur

NEED ANALYSIS :

It was considered essential to revise the curriculum of diploma course im electrical engineering to accomodate new areas of technology as well as update the existing course contents so as to make it more relevant to the needs of the world of work.A Number of professionals representing various field organisations , higher technological institutions, I.E.R.T. Allahabad and polytechnics of the State were involved to update the curriculum in electrical engineering.

Exeperts from the field and higher technological institutes emphasised the need of making the curriculum more technology oriented and practice based. Experts from the field were also of the view that the curriculum should be broad-based in nature,so as to provide larger base of employment flexibility in functioning.

The need for developing information gathering and communication & problem solving activites were also stressed.

It was also suggested by the experts from higher technological institutes that it is very essential that diploma courses should have a foundation of applied sciences up to 10+2 standard. Applied sciences are very essential to develop learning to learn skills in the students.

The professionals from the field were of the view that dead wood from the courses be deleted and courses should not be stuffed with unnecessary information.

Based on the above, curriculumn of diploma course in Electrical Engineering was revised.

Job opportunities, activities,activity analysis in to knowledge, skill and attitude requirement and curriculum objectives formed the basis of arriving at the course contents.

I JOB OPPORTUNITIES

S.NO.	Department/Organisation	Position/Designation
1.	State Electricity Boards and state PWDs (Electrical wing),Municipal Corporations State Housing Boards.	Junior Engineer/ Sectional Officer/ Foreman/Line Inspector
2.	Central Government Departments (Post and Telegraphs, Telephones, Radio/Doordarshan National Building Construction Corporation, NTPC, NHPC, Nuclear Power Corporation,Food Corporation of India, Ware Housing Corporation, Shipping Corporation of India, Oil and Natural Gas Commision, CPWD, Central Electricity Authority.	Supervisor/Foreman/ Sectional Officer/ Junior Engineer/ Technical Assistant
3.	Indian Railways	Supervisor/Foreman Electrical Inspector
4.	Civil Aviation	Senior Technician
5.	Military Engineering Services(MES)	Supdt. Grade-II
6.	Vocational and Junior Technical Schools.	Vocational Masters/ Technical Teachers.
7.	Banks, General Insurance Company	Technical Assistants Field Supervisors.
8.	Government Undertakings manufacturing Electrical machines and equipments. (HAL, BHEL, ITI etc.)	Maintenance Supervisor/ Electrical Foreman
9.	Private Sector Undertakings Manufacturing Industries/ Organisations (large/ medium scale).	Service Centre Incharge Production Controller Technical Assistant
10.	Private Electrical Contractors	Technical Assistant
11.	Research Laboratories	Technical Assistant/ research Assistant/ Design Assistant

12.	Technical Education Institutions (ITIs & Polytechnics)	Instructors & Demonstrators
13.	Sales and service of Electrical Products.	Sales Representative service Technician.
14.	Self Employment in:	
(i)	Repair and Maintenance of Electrical equipments, Machines and appliances.	Owner/Partner
(ii)	Manufacturing of House-hold appliances.	
(iii)	Ancillary to big units.	
(iv)	Wiring contractor.	

II JOB ACTIVITES OF DIMPLOMA-HOLDERS IN ELECTRICAL ENGINEERING

(A) Investigation (R & D)

1. Conducts electrical load survey.
2. Prepares reports of load survey.
3. Conducts route survey for marking postions of poles as per given plan of the line and identify soil conditions.
4. Collects information for determining type and location of faults regarding breakdown of wiring installation, overhead and underground & distribution lines, sub-station equipment, panel boards and machines.

(B) Design and Drawing (R & D)

1. Designs electrical installations for residential / commercial / buildings and industries and commercial establishments.
2. Prepares wiring diagrams of electrical installations.
3. Prepares design and drawing of motor control circuits, signals/alarm and panel baord control ciruits.
4. Interprets drawing of electrical installations.
5. Assists the engineer in designing distribution system of an area.
6. Designs simple and small electrical and electronics circuits & appliances like battery eliminator, simple transfomer etc.

(C) Testing, Research and Development (R & D)

1. Tests electrical installation, equipment and machines as per Indian Standard specifications.
2. Tests and calibrates the electrical & electronic instrument including meters.
3. Tests installations and control equipment after repair, takes remedial measures to avoid reccurrance of fault.
4. Writes test reports.
5. Assists the engineer in research and development work.

6. Tests electronic & electric component & circuits.

(d) Management and Supervision (Production, Installation, Operation).

1. Prepares meterial equipment and labour schedule for electrical installations.

2. Supervises the installation of internal wiring, underground and over head distribution lines, motor control systems, H.T. and L.T. Service connection, earthing etc. as per specifications.

3. Prepares details of work for fabrication, supervises construction and erection of electric installations according to specification and schedule.

4. Identifies critical areas requiring close supervision during installation for satisfying safety requirement or tolerance of dimension.

5. Supervises manufacturing processes of electrical equipment/goods for quality control and workmanship.

6. Keeps record of progress of work and sends progress reports to engineer-incharge.

7. Receives and issues material and instruments to workers.

8. Prepares inspection and testing schedule for installation/equipment.

9. Maintains record of public complaints and take measures for rectification of faults in electric installations.

10. Visits site of faults plans and arranges fault rectification.

11. Ensures proper procuring storing and stocking of equipment/material.

12. Communicates with workers and resolves their grievances.

13. Ensures safety of workmen during operations.

14. Undertakes physical verification of stores.

15. Operates control room of substation/Industry

16. Specifies machine, equipment, wiring

installation acessaries and tests them.

17. Fabricates simple & small electrical & electronics circuits, and appliances like transformer, battery eliminator, etc.

(E) Estimating and Costing

1. Reads drawing of electrical installation and calculates quantity of material required for various electric installation and power projects (overhead distribution line, substation underground distribution line, service connection etc.)

2. Writes specifications and selection of the material required for various electric projects.

3. Checks bills of contractor (s) for payment by referring schedule of rates prescribed by electricity authorities.

4. Verifies rates for various items of works.

5. Works in Design and planning.

(F) Maintenance and repairs (Services)

1. Reviews performance of line and equipment at intervals.

2. Detects faults in installations and arranges for their rectification.

3. Undertakes routine and preventive maintenance of electrical instruments/ equipment/ installations.

4. Prepares inspection schedules.

5. Prepares estimates for repair and maintenance.

6. Undertakes repairs of electrical machine, equipment & appliances etc.

III ACTIVITY ANALYSIS (In terms of knowledge and skill)

S.No.	ACTIVITIES	KNOWLEDGE	SKILL
(A)	INVESTIGATION:		
1.	Conducts load survey and prepares report.	Symbols, specifications of installation, drawing and their types, distribution systems, demand factor, load factor, diversity factor.	Skill to load survey interpretation of drawing sketching calculation of various factors,preparation of survey report.
2.	Conducts route survey for marking positions of poles as per given plan of the lines and identifying soil condition.	Transmission and distribution systems and their layout, interpretation of drawings survey instruments and their uses (chain surveying dumpy level) standard norms for pole erection, soil sampling procedure. Knowledge of types.	Skill to interpret drawings marking pole location, chaining and levelling for route survey for pole/towers for LT/HT lines.
3.	Collects informations for determining types and location of faults regarding break down of wiring installation overhead and under ground distribution lines, sub-station equipments, panel boards and machines.	Knowledge of types of faults, reasons, method of location, types of wiring, overhead & under ground lines knowledge of equipments, panel board and machines, like Gen.,Motors, transformers.	To locate and find causes of faults and prepare report and mark them and interprete drawings.
(B)	Design and Drawing		
1.	Designs electric installation for small residential buildings and shops.	Knowledge of types of loads, calculation of loads, type of wiring system for residences, shops, industries, norms, and specifications of material required calculation of elect.	To make calculation of loads. prepare design of wiring instllations from a given plan.

		load.	
2.	Prepares wiring diagram of electrical installation.	Knowledge of symbols of switch, socket, lamp and fan points, etc. Knowledge of drawing/wiring ckt. diagrams of installations specifications.	Skill to prepare drawings of wiring and control circuits.
3.	Prepare design and drawing of motor control circuits signal/alarm circuits, pannel board control circuits.	Knowledge of motor control system, signal and alarm circuits panel boards circuits systems of control relays, contactors, push Button on, NO/NC type indi-cating devices/ alarm devices.	Skill to drawing and read and make control alarm circuit used for information hostel, hospital and offices etc.
4.	Assists the Engineer in designing distribution system in an area.	Knowledge of type of loads in dome-stic, industrial how to do load survey of the area collects, the data of loads survey for location of route of line.	Collecting and compiling information data loads.
5.	Designs simple and small electrical & electronics circuits and appliances.		
(C)	TESTING, RESEARCH AND DEVELOPMENT		
1.	Tests Electrical installation, equipments and machines as per Indian Standard specifications.	Working principles, construction appli-cations and speci-fications of the various equipments Ammeter, Voltmeters Wattmeters energy meter, Gen., Motors Use of testing equipments and standards and specifications. knowledge of reading/ understanding the drawing of concerned equipment and machines and installations.	Skill to test wiring insta-llation Elect-rical Gen., Motor transfor-mer as per specification skill to test measuring instruments.

		Meggar, Earth testers, insulation tester on testing sets, Multimeter etc.	
2.	Tests and calibrates the electrical & electronics instruments including meters.	Working principle, construction,appli- cation of the instruments, like ammeter voltmeter Wattmeter, energy meter,power supplies multimeters CRO etc. Methods of testing, calibrations, know- ledge of standards and specification.	Skill to that and callibrate measuring instruments.
3.	Tests installations control equipments after repair and takes remedial measures to avoid reccurance of faults.	Knowldege of use of testing equipments required in testing installations, knowledge of repair and maintenance to provide remedial measures. (Knowldege of remedies of faults).	Skill to locate faults and to make arrangement of remedial measures and means.
4.	Writes test reports	Knowledge to pre- pare test sche- dule, recording of test dates and preparing the reports to supply information.	Skill to collect test information and compile reports.
5.	Assists the Engineer in research and development work	Knowledge of meas- uring equipment & compile information from tests,measure- ments.knowledge of quality control & management.	Skill to under- stand the problem of workers in executing works or manufacturing process.To comm- unicate it to engineer for improvement of working condition and manufacturing process toimprove quality ofproduct
6.	Tests electronic & electric components and circuits.	Knowledge of elect. & electronic circuits and components	presence of mind and working skill

(D) MANAGEMENT AND SUPERVISION
(Production, installation, operation)

1.	Prepares material, equipments and labour schedule for electrical installations.	Knowledge of Elect. Engg. materials and equipment used in electrical installations. Knowledge to maintain records and schedule of materials. Knowledge of industrial management.	Skill to supervise and arrange the material. Skill to supervise the work and to communicate with workers.
2.	Supervises the installation of internal wiring U.G. and over head Transmission and distribution lines, motor control systems HT & LT service connections, earthing as per I.S. specifications.	Different methods of wiring, construction of U.G. Cables, principle of motor & generator, different methods of HT & LT service mains, earthing as per IS.	To supervise installation work for achiving satisfactory results.
3.	Supervises the Manufacturing processes.	Manufacturing process of various electrical goods, their construction and material used, quality control procedures safety, tolerance of dimensions; Labour relations, knowledge of fabrications techniques.	To supervise the manufacturing of electrical goods.
4.	Keeps record of progress of the works and reports progress to higher officials.	Different methods of keeping record e.g. log-books measurement book etc.	Record keeping and reporting.
5.	Receives and issues material and equipments to workers.	Different procedures of maintaining stock register, specification of equipments and material required.	Inventory control.
6.	Prepares inspection and testing schedule for installation/equipments.	Specification of installation/equipment, testing procedure preparation of inspection and testing	Skill of inspection and testing.

		schedule/charts.	
7.	Maintains record of public complaints and takes suitable steps for their redressal.	Knowledge of faults inspection and testing of lines, labour management.	To maintain public utility system.
8.	Inspects the sites, of faults on LT/HT lines and their removal.	LT/HT lines and their testing, route inspection.	Plan and execute removal of faults in HT/LT lines.
9.	Storing/stacking of material/equipments and verification.	Specifications of electrical equipments and materials, storing/stacking procedures, store record keeping.	Store keeping of electrical materials.
10.	Communicates with workers and removes their grievances.	Labour relations and Industrial management, communication techniques.	Human resource management.
11.	Ensures safety of workmen during work.	Safety rules pertaining to different activities HT/LT, power house, S/S.	To carry on the work safely.
(E)	ESTIMATING AND COSTING:		
1.	Reads drawing of electrical installations and calculates quantity of material required.	Drawing of electrical installation,material specification, estimation of quantity.	Estimation of quanities material required.
2.	Prepares specifications and test of material for various electrical projects.	Specification of various items, drawing of project.	Estimation of quantities of material required.
3.	Verifies bills of Contractor for payment.	Schedule of rates, measurement techniques, specifications of various items used in the installation.	Inspection of existing installation as per specification.
4.	Verifies/Analyses rates for various items of works.	-do-	Capability of analysing rates prevailing in the market.

F) MAINTENANCE AND REPAIRS:

1.	Repairs and maintains lines and equipments periodically.	Knowledge of LT/HT distribution and transmission lines and equipments used for their protection. Knowledge of types of equipments used with lines.	Maintenance of LT/Ht lines and equipments.
2.	Detects faults in installations and arranges for their rectifications.	Knowledge of types of faults, methods of locaton/detection. Knowledge of working of installation (working of sub-station, LT, HT Lines control circuits etc.)	Fault location, maintenance & repair.
3.	Undertakes routine and preventive maintenance of electric instruments/machines/ equipments/ installation.	Knowledge of instruments, equip-ments, machines and installations. (Meas-uring, recording instrument motor/ transformer etc, sub-station, power house, LT/HT lines etc.) Knowledge of protect-ion methods, routine maintenance schedule.	Inspection protection, repair and maintenance.
4.	Prepairs inspection schedule.	Knowledge of specifi-cation & preparation of inspection schedule with specification.	Ability to prepare inspection schedule.
5.	Prepare estimate for repairs and maintenance.	Knowledge of faults, material required, rates as per schedule, specifications to prepare estimate of quantity of material required. Labour required and their rates as per schedule.	Capability to prepare estimates.

IV. CURRICULUM OBJECTIVES

(A) KNOWLEDGE

(1) Understanding of Electrical load survey, load fector, diversity factor, demand factor and various types of power plants.

(2) Knowledge of surveying of route for installation of lines, LT/HT, distribution and transmissions lines.

(3) Knowledge of LT, the distribution and transmission system methods and equipments used for protection.

(4) Knowledge of pole mounted, in door, outdoor substations, grid stations and machines and equipment used at substations. Protection system and equipment used for protection.

(5) Knowledge of Basic Electricity DC quantities and units Magnetism. Principles of measurement and measuring instruments.

(6) Knowledge of standardization and callibration and testing of instruments.

(7) Knowledge of fault location, type of faults, methods for location and detection of faults in (i) lines (L.T., H.T.) (ii) Electrical Machines, generators, Motors & Transformers (iii) Equipments.

(8) Knowledge of protection systems, equipment alarm system, control system.

(9) Knowledge of symbols used in drawing of control system alarm and protection system.

(10) Knowledge of residential building, commercial and industrial wiring system type of working electrical material required to prepare drawing, estimating and costing, symbols of electrical switches, holders, fans, sockets and other domestic equipment etc.

(11) Knowledge of working principle of Electrical motor, generators D.C. and A.C., transformer (Single phase and 3-phase) Instrument transformers.

(12) Knowledge of different types of electrical light sources used in electrical installations layout , construction and specification. Design of illumination schemes.

(13) Knowledge of Electrical welding Electrical heating system used in industries.

(14) Knowledge of electrical systems used for referigeration and air conditioning.

(15) Knowledge of supervision of work of Electrical installations, manufacturing of electrical machines and appliances etc.

(16) Knowledge of basic electronic components, circuits & devices.

(17) Knowledge of the computer basics, language Programming and application.

(18) Knoledge of present global energy scenario, understand the impact of energy crisis, alternate sources of energy, identify the renewable sources of energy, understand the phenomena of solar radiation, basic earth/sun angles, data book on solar energy, applications of solar energy (thermal/conversion), Efficiencies of solar systems, biomass energy potential, methods of biogas production, use and applicatios of alcoholic fuels, wind energy potential, various types of wind mills, efficiency/ power of wind mill, method of microhydel power generation, factors affecting site sellection, geothermal energy potential, method of power production from geothermal energy, tidal energy, methods of power generation from waves and tides.

(B) SKILLS

1. Must be capable of doing load survey, compile records and prepare drawings.

2. Must be able to survey the route for installing poles/towers for LT/HT lines.

3. Must be able to detect and locate faults and prepare report relating to LT/HT lines, sub stations, electrical machines/equipment, panel boards.

4. Must be able to calculate domestic, Industrial loads/commercial electrical loads, and from plan prepare design and drawings of wiring circuits.

5. Must be able to handle electrical control circuits.

6. Must be able to test electrical installation equipment and machines as per specifications/ standards.

7. Must be able to test and calibrate measuring instruments.

8. Must be able to provide remedial measures to avoid reoccurance of faults in installation, lines and machines and system repairs.

9. Must be able to superwise work as per plan.

10. Must be able to supervise manufacture of electrical goods in an organisation.

11. Must be capable to handle labour or workers problems.

12. Must be skilled to supervise repair and maintenance of electrical installation equipments machines etc.

13. Must have skill to prepare plan progress reports, of work of electrical installation for information to Engineer/Deptt.

14. Must be able to make inventories, maintain stores and stocking of electrical material and equipment.

15. Must be able to prepare test report inspection schedule of installations.

16. Must be able to do repair and maintenance of electrical distribution line and source lines (To maintain public utility system).

17. Must be able to provide safety required for workers.

18 Must be able to prepare estimate of quantity and cost of electrical installation.

19. Must be able to do protections, repair and maintenance of transmission lines , Electrical Machines.

20. Must be able to detect faults in electronic circuits used in electrical installation, equipment & control circuits.

21. Must be able to do operation of computer, writing of small programmes & use of given software in applications.

V. CURRICULUM ANALYSIS FOR IDENTIFYING SUBJECTS OF STUDY

(In terms of knowledge and Skill)

S.No.	Knowledge	Curriculum Area/ Subject suggested.
1.	Understanding of Electrical load survey, load factor, diversity factor demand factor, and various types of power plants.	a) Power System
2.	Knowledge of surveying of route for installation of lines, LT/HT distribution and transmission lines. Location of poles, towers etc. Rough planning and making drawings.	a) Chain Survey b) Use of dumpy level c) Transmission and Dis tribution system. d) Electrical Drawing of power system.
3.	Knowledge of LT, the distribution and transmission system methods and equipments used for protection	a) Electrical T & D system. b) Protection system
4.	Knowledge of pole mounted indoor, outdoor and grid substation, and equipment used at substations. Protection system.	a) Power transmission LT, HT system. b) Sub-station (Power system) c) Protection system
5.	Knowledge of Basic Electricity AC, DC quantities magnetism and units, Principle of measurements and measuring instruments.	a) Basic electricity b) Electrical instru-ments and measure-ments. c) Electrical Engg. materials.
6.	Knowledge of standards & callibration and testing of instruments.	a) Electrical measur-ing instruments.
7.	Knowledge of fault location, type of faults, methods for location and detection of faults in i) Lines (LT/HT) ii) Generators Motors and Transformers. iii) Equipments.	a) Electrical machine b) T & D system c) Power system (Gen. protection) d) Instrument/ equipments.
8.	Knowledge of protection systems, equipment alarm system, control system.	a) Power protection b) Control and alarm system. c) Control circuits drawings.
9.	Knowledge of symbols used in drawing of control system, alarm and protection system.	a) Electrical design drawing

10.	Knowledge of residential building commercial and industrial wiring system, type of wiring, material required to prepare drawing, estimating and costing, symbols of electrical switches, holders, fans sockets and other electric equipment etc.	a) Wiring system b) Estimating costing c) Electrical Drawing d) Electrical materials e) Electrical shop practice.
11.	Knowledge of working principle of Electrical motors, generators (DC & AC) Transformer (single phase and 3-phase), instruments transformers.	a) Electrical machines DC generators & motor b) Electrical machine, generator and motors. c) Electrical Engg. materials d) Electrical shop practice.
12.	Knowledge of different types of electrical light sources used in electrical installation principle, construction and specification. Design and illumination schemes.	a) Electrical utilisation b) Electrical Design & Drg. c) Electrical Engg. material.
13.	Knowledge of Electrical welding, Electrical Heating system used in industries.	a) Utilisation of Electrical Energy. b) Electrical Appliances
14.	Knowledge of Electrical systems used to refrigeration and air conditioning.	a) Utilisation of Elect cal energy. b) Electrical control as applied to a/c.
15.	Knowledge of supervision of work of electrical installations manufacturing of electrical machine, appliance etc.	a) Industrial management b) Electrical machines/ equipment. c) Electrical appliance d) Electrical Engg. material. e) Electrical drawing.
16.	Knowledge of basic electronic components, circuits, & devices.	a) Electronic circuit & devices.
17.	Knowledge of the computer language Programming & application	a) Computer Basics & Programming

Sl.NO.	Skills	Curriculum Area/ Subjects suggested.
1.	Capable of doing load survey, compile records and prepare drawings.	a) Electrical Drawing b) Power systems.
2.	Able to survey the route for installing poles/towers for LT/HT lines.	a) Transmission and distribution. b) Electrical Drawing of power system.
3.	Detect and locate faults and prepare report relating to LT/ HT lines sub-stations, Electrical machines/equipment, panel boards	a) Transmission and Distribution. b) Protection system c) Power systems d) Electrical machines/ equipment.
4.	Calculate domestic, Industrial commercial electrical loads and plan to prepare design and drawing of wiring circuits.	a) Electrical Estimating and costing. b) Electrical design and drawing. c) Electrical shop practice.
5.	Handle Electrical control circuits.	a) Electrical drawing of control circuits. b) Electronics as applied to control ciruits. c) Electrical shop practice.
6.	Test Electrical installations/ equipment and machines as per specifications/standards.	a) Electrical power system . b) Electrical transmission and distribution. c) Electrical machine. d) Electrical equipment.
7.	Test and callibrate measuring instruments.	a) Electrical measurements and measuring instruments.
8.	Provide remedial measure after repairs to avoid reccuracne of faults in installation/ lines/ machines/system repairs.	a) Power system b) Transmission and distribution. c) Electrical machines d) Maintenance methods e) Electrical shop.
9.	Superwise work as per plan.	a) Labour/industrial management.

10.	Supervise the manaufacture of electrical goods in an organisation.	a) Electrical machine b) Electrical instrument equipment. c) Electrical appliances. d) Industrial management e) Fabrication Techniques.
11.	Be capabel to handle labour or workers problems.	a) Industrial management.
12.	Supervise repair and maintenance of electrical installation/ equipments machines etc.	a) Electrical Machines b) Equipements c) Work management d) Electrical workshop
14.	Make inventories to maintain stores and stacking of Electrical materials and equipments.	a) Store Management b) Store receipt and issue system, for material and equipment. c) Electrical material.
15.	Prepare test report/inspection schedule of installations.	a) Electrical power system b) Power stations practice c) Sub Station Practices.
16.	Repair and maintenance of distribution line and service lines (To maintain public utility system).	a) Work Management. b) Electrical Distribu-tion system.
17.	Proved safety methods required for workers.	a) Safety Methods b) Indian Electricity Rules.
18.	Prepare estimate of quantity and cost of electrical installation.	a) Electrical material b) Estimating & Costing c) Electrical Design & Drawing. d) Wiring system
19.	Protect repair and maintenance of HT Transmission/Distribution lines, Electrical Machines.	a) Transmission Lines b) Protection Systems c) Electrical Machine d) Electrical Power system.
20.	He must be able to detect faults in electronic circuit used in electrical installation equipment & control circuit.	a) Electronic Circuits & devices b) Control of Machines c) Electrical Design & Drawing
21.	He must be able to operate computer, writing of small & application programmes & use of given software.	a) Computer Programming
22.	Supervise & Operate Solar biomass wind microhydel power plants	a) Renewable sources of energy as optional subject

VI. ABSTRACT OF CURRICULUM AREAS

1 I YEAR

1.1. Professional Communication
1.2. Applied Mathematics-I
1.3. Applied Physics
1.4. Applied Chemistry
1.5. Engg.Drawing
1.6. Basic Electrical Engineering
1.7 Electrical and Electronics Engg. Materials
1.8 Electronics-I
1.9. Workshop Practice

2. II YEAR

2.1. Applied Mathematics-II
2.2. Electronics II
2.3. Elect.design drawing & estimating-I
2.4. Electrical Instruments and Measurements
2.5. Elementary Mech. & Civil Engg.
2.6 Introduction to Computer
2.7. Electrical Machine-I
2.8. Power Plant Engineering
2.9. Transmission and Distribution of electrical Power
2.10 Electrical Machine
2.11 Generation, Transmission and Distribution
Of electrical Power
2.12 Power Electronics

3. III YEAR

3.1 Industrial management and entrepreneurship development
3.2 Installation,maintenance & repair of electrical machines
3.3 Switch Gear and Protection
3.4 Environmental Education & Disaster Management
3.5 Electrical Project (i) Problem
(ii) Field Exposure
3.5 Industrial Electronics and Control
3.6 Elect.design drawing and estimating II
3.7 Utilisation of Electrical Energy
3.8 Electrical Machine II
3.9 Elective (anyone of the following)
A. Control of Electrical Machines
B. Process control & instrumentation
C. Electric traction
D. Renewable Sources of Energy
E. High Voltage Engineering
F. Energy Management
3.10 Industrial Control I
3.11 Industrial Control II
3.12 Control System & Process Application
3.13 Microprocessor Development Systems
3.14 Electrical & Electronics Instrumentations

I YEAR

1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L	T	P
3	-	2

Rationale:

Communication forms an important activity of diploma holder. It is essential that he/she should be in a position to communicate in writing and orally with superiors,equals and subordinates. This subject aims at providing working knowledge of languages like Hindi and English so as to train the students in the art of communication. It is suggested that maximum attention should be given in developing Communication abilities in the students while imparting instructions by giving maximum emphasis on practice.

Sr.No.	Units	Coverage time L	T	P
1.	Introduction to communication methods meaning,channels & media written and verbal.	5	-	-
2.	Development of comprehension of English & Hindi through study of text material& language exercises.	20	-	-
3.	Development of expression through A. Letters(English & Hindi) B. Report writing (English) Note making and minutes writing	 10 10	 - -	 - -
4.	Composition	10	-	-
5.	Grammer	20	-	-
		75	-	50

1. PART I : COMMUNICATION IN ENGLISH

1.1 Concept of communication, importance of effective communication, types of communucation, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writting and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.

1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Letters :

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters. Application for a job.

1.3.2 Report writing and Note making and minutes writing.

1.4 Grammer : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.

1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II : COMMUNICATION IN HINDI

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.

2.2 Development of expression through ;

Letter writing in Hindi:
Kinds of letters:-
Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters, Application for a job.

(1) Paper should be in two parts, part I - English and part II Hindi.

COMMUNICATION AND PRESENTATION PRACTICES

1.A. Phonetic transcription
B. Stress and intonation :
(At least 10 word for writting and 10 word for pronunciation)

2. ASSIGNMENT : (Written Communication)

Two assignment of approximately 400 word each decided by the teachers.

SUGGESTED ASSIGNMENTS :

1. a picture/photograph
2. an opening sentence or phrase
3. a newspaper/magzine clipping or report
4. factual writting which should be informative or argumentative.

3. Oral Conversation:

1. Short speeches/declamation : Bid farewell, Felicitate somebody, Celebrate a public event, Offer condolences
2. Debate on current problems/topics

3. MockInterview : Preparation, Unfolding of personality and Expressing ideas effectively
4. Group discussion on current topics/problems
5. Role Play/ general conversation : Making polite enquiries at Railway Station, Post Office, Banks and other Public places, Replying to such enquiries, enquiring about various goods sold in the market and discussing their prices. Complaining about service at Hotel, restaurant, Offering apologies in reply to such complaints, complain to a company about a defective product you have brought, reply to such complaints.
6. Presentation skill, Use of OHP and LCD.

4. Aural :

Listening to conversation/talk/reading of short passage and then writting down the relevant or main points in the specified number of words and answering the given questions

The assignments/projct work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g.

10 marks for assignment (Given by subject teacher as sessional marks)
10 marks for conversation and viva-voce
10 marks for phonetic transcription

STRUCTURE OF COMMUNICATION TECHNIQUE PAPER

Distribution of Marks

Theory Paper : 50 Marks
Sessional : 20 Marks
Pratices : 30 Marks

Q1. Question based on the topics prescribed text material will be set to test the candidates ability to understand the content, explain words and phrases, making sentence of given words and ability to summarise will be included. All questions will have to be answered.

A. from English Text Book 10 Marks
B. from Hindi Text Book 5 Marks

Q2. Candidates will be required to write one letter (English) and one letter in (Hindi) from a choice of two -

A. English Letters 5 Marks
B. Hindi Letters 5 Marks

Q3. Report Writting on given outlines 5 Marks

Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammer, structure and usage of the language. All the items in this question will be compulsory. The grammar questions has four parts -

(Total Part: A For 5 Marks, B For 3 Marks, C For 3 Marks and D For 4 Marks)

A. This part of the question has to do with the transformation of sentences. English uses several patterns of sentence formation and the same meaning can be expresed by several patterns e.g. Active to Passive voice and vice versa, Direct to Indirect and vice versa, Reframing sentences by changing part of speech e.g Noune to Adjective, Interchanging degree of comparison.

   Interchanging Moods - Affirmative to Negative, Assertive to Interrogative or to exclamatory

B. The second part usually requires blanks in a sentence to be filled in with a suitable preposition and articles.

C. The third part is usually an exercise on tenses.

D. The fourth part concerns with one word substitution and abbrevation, uses of idioms and Phrases.

Q5. COMPOSITION : (About 300 Words) (5 marks)

Candidates will be required to select one composition topic from a choice of five. The choice will normally include narrative descriptive, argumentative, discussion and factual topics. The main ceteria by which the composition will be marked are as follows

A. the quality of the language employed, the range and appropriateness of vocabulary and sentence structure the correctness of grammatical construction, punctuation and spelling.

B. The degrees to which candidate have been successfully in organising both the composition as a whole and the individual paragraphs.

1.2 APPLIED MATHEMATICS I

[Common to All Engineering Courses]

L	T	P
3	2/2	-

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Coverage Time L	T	P
1.	Algebra-I	18	6	-
2.	Trigonometry	7	2	-
3.	Coordinate Geometry	15	5	-
4.	Differential Calculus-I	15	5	-
5.	Integral Calculus-I	20	7	-
		75	25	-

DETAILED CONTENTS:

1. ALGEBRA-I :

1.1 Series : AP and GP; Sum, nth term, Mean

1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.

1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule

1.4 Vector algebra : Dot and Cross product, Scaler and vector triple product. Application to work done, Moment of a force, Plane geometry.

2. TRIGONOMETRY :

2.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.

2.2 Complex number.

Complex numbers, Representation, Modulus and amplitud Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

3. CO-ORDINATE GEOMETRY :

3.1 Standard form of curves and their simple properties -

Parabola $x^2=4ay$, $y^2=4ax$,

Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2}=1$

Hyperbola $\frac{x^2}{a^2} + \frac{y^2}{b^2}=1$

Tangent and normals

3.2 Straight lines, planes and spheres in space -

Distance between two points in space, direction crossing and direction ratios, Finding equation of a straight line, and shortest distance between two lines

Under different conditions equation of a plane $lx+my+nz=c$, relation between lines and planes, sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$

4. DIFFERENTIAL CALCULUS - I :

4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, - Function of a function, Logaritimic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.

4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.

4.4 Application - Finding Tangants, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

5. INTEGRAL CALCULUS - I :

5.1 Methods of Indefinite Integration :- Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.

5.2 Meaning and properties of definite integrals, Evaluation of definite integrals.

5.3 Application : Finding areas bounded by simple curves, Length

of simple curves, Volume of solids of revolution, centre of mean of plane areas.

5.4 Simpsons and Trapezoidal Rule : their application in simple cases, Concept of error for simple function.

1.3 APPLIED PHYSICS

[Common to All Engineering Courses]

L	T	P
3	2/2	2

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject,teachers should make maximum use of demonstrations to make the subject interesting to the students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Measurement	4	1	-
2.	Vector	3	1	-
3.	Force and Motion	4	1	-
4.	Dynamics of rigid body (Rotational Motion)	4	1	-
5.	Fluid Mechanics and Friction	4	1	-
6.	Work,Power and Energy	4	2	-
7.	Elasticity	2	1	-
8.	Simple Harmonic Motion	4	1	-
9.	Heat Transfer & Radiation	4	2	-
10.	Application of Sound Waves,Acoustics and Ultrasonics	6	2	-
11. A.	Optics	4	1	-
B.	Fiber Optics	4	1	-
12.	D.C. Circuits	4	1	-
13.	Dielectrics	4	2	-
14.	Magnetic Fields and Materials	4	2	-
15.	Semi Conductor Physics	5	1	-
16.	Nuclear Physics	4	2	-
17.	Laser & its Application	4	1	-
18.	Non-conventional energy sources	3	1	-
		75	25	50

DETAILED CONTENTS:

1. Measurement
   a) Units and Dimensions

Fundamental and derived units :

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogenity of dimensions and applications of homogenity principle to:

i) Checking the correctness of physical equations,

ii) Deriving relations among various physical quantities,

iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.

b. Errors in measuremnts, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement(Combination of erros in addition, substraction, multipication and powers). Significant figures, and order of accuracy in resprect to instruments, Standard deviation, Variance.

2. Vector :

Scalar and vector quantities; Addition, Subtraction, Resolution of vector- Cartesian components of vector, Scalar and vector product of two vector.

3. Force and Motion

Parabolic motion, projectiles thrown horizontally and at an angle. Problems on time of flight, horizontal range, and maximum horizontal range. Central forces. Circular motion, angular velocity,angular acceleration and centripetal acceleration.Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge. Gravitational force, Motion of satellites, Kepler's laws, Escape velocity, Geo-stationary satellite, Concept of Black holes, Jet propulsion theory, Motion of Multi-stage Rocket, SLV, PSLV and GSLV Rockets.

4. Dynamics of Rigid Body (Rotational Motion)

Rigid body,Rotational motion, Moment of inertia,Theorems(Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies, Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling down the slant planes.

5. Fluid Mechanics & Friction

Surface tension, Capillaries, Equation of continuity (A1V1=A2V2), Bernoulli's theorem, stream line and Turbulent flow, Reynold's number.

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Static and dynamic frictional forces. Coeffi- cients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.

6. Work, Power and Energy

Work done by force on bodies moving on horizontal and inclined planes in the presence of frictional forces,Concept of power and its units. Calculation of power (simple cases). Concept of kinetic and potential energy, various forms of energy, Conservation of energy. Force constant of spring, potential energy of a stretched spring.

7. Elasticity

Elasticity, stress and strain. Hooke's law, elastic limit.Yielding point and breaking point. Modulus of elasticity Young's modulus, bulk modulus and modulus of rigidity, Poisson ratio, Resilience.

8. Simple Harmonic Motion

Periodic Motion , characterstics of simple harmonic motion; equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Spring-mass system. Simple pendulum. Derivation of their periodic time. Energy conservation in S.H.M. Definition of free, forced, undamped and damped vibrations, Resonance and its sharpness, Q-factor.

9. Heat Transfer and Radiation

Modes of heat transfer , coefficient of thermal conductivity and its determination by (i) Searle's method for good conductors, and (ii) Lee's method for poor conductors. Conduction of heat through compound media, Conduction and convection, Radial flow of heat, Blackbody radiation, stefan's law, Wein's displacement and raleigh-Jeans laws, Planck's Law.

10. Application of Sound Waves

Acoustics

Standing waves, Closed and Open organ pipes, Resonance, End-correction.Definition of pitch, loudness, quality and intensity of sound waves. Echo and reverberation and reverberation time. Sabine's formula. Control of reverberation time (problems on reverberation time). Accoustics of building defects and remedy.

Ultra-Sonic :

Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

Quantum nature of light, Coherrence (Spatial and temporal), Duality of wave and particle, Concept of Interference, Biprism, Fraunhoffer single and N-slit diffraction, Grating, Resolving and dispersive power, Elementary concept of

polarisation.

B. Fibre Optics :

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

12. D.C. Circuits

Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); potentiometer, Kirchoff's Law and their simple application. Principle of Carey-Foster's bridge. Electric potential, potential energy, Energy of a changed capacitor. fleming left hand rule, torque on a current loop, Moving coil, Galvano meter. Charging/discharging of capacitors, Ballistic galvonometer, its charge sensitivity and Current sensitivity.

13. Dielectrics :

Electric dipole; effect of electric field on dielectrics, polarisation.

14. Magnetic Fields & Materials :

Dia, Para and Ferro-magnetism, Ferrites, Hysteresis, Methods of plotting, Hysteresis curve of a ferro magentic materials and their uses, Magnetic circuits, Energy stored in magnetic fields, Basic idea of super conductivity, Meissner's effect, Applications.

15. Semiconductor Physics

Energy bands in soldis, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semi conductors, Electrons and holes as charge carriers in semiconductors, Effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Majority and Minority charge carriers, Base, emitter and collector currents and their relationship LED's, Photo-electric effect and photo devices.

16. Nuclear physics

Radioactivity, Nuclear stability, Radioactive emmission, radiation damage, Nuclear fission and fusion, Nuclear reactors (PHWR-type and fast breader) and their application, Mass-energy relation, Automatic mass unit, Mass defect and binding energy.

17. Lasers and its Applications

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Einstein's co-efficients, Poluation inversion, Main component of laser and types of laser- Ruby Laser, He-Ne and Semi-conductor laser and their applications. Principles of Holography, Introduction to MASER.

18. Non-conventional energy sources:

(a) Wind energy : Introduction, scope and significance, measurement of wind velocty by anemometer, general principle of wind mill, Indian wind energy programme.

(b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Insolation meter (suryamapi) uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector, Solar PV plants in India, Modern applications in technology.

PHYSICS LAB

Note: Any ten experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.

2. Determination of 'Y' (Young's Modulus) by Searle's Method.

3. Determination of 'g' by plotting a graph T2 verses l and using the formula g=4n2/Slope of the graph line

4. Determination of Spring constant.

5. Determination of viscosity coefficient of a lubricant by Stoke's law.

6. Determination of 'k' for good conductor (Searle's Method).

7. Determination of frequency of AC mains by melde's methods (Transverse and Longitudinal Mode)

8. Determination of velocity of sound by resonance tube.

9. Determination of E1/E2 by potentio meter.

10. Determination of specific resistance by Carry Foster bridge.

11. Determination of resitivity by P.O.Box.

12. Verification of Kirchoff's Law.

13. To observe Characteristics of p-n Junction diode on oscillscope.

14. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.

15. To measure solar intensity (determine solar constant) with the help of Insolation meter (Suryamapi).

16. Demonstration of He-Ne laser (Interferometer)

17. Determination of internal resistance by potentiometer.

NOTE :

Students should be asked to plot a graph in experiments (where possible) and graph should be used for calculation of results. Results should be given in significant figures only.

1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L	T	P
3	-	2

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge alongwith productive practice to the students of the diploma engineering. The teachers are expected to guide the students in the classroom and the laboratories according to the curriculum by demonstrations and by showing relevant materials and equipments to inculcate interests in learning among students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Streochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
		75	-	50

DETAILED CONTENTS:

1. ATOMIC STRUCTURE :

Basic concept of atomic structure, Matter wave concept, Schrodinger wave equation, Quantum number, Haisenberg's Uncertainty Principle, Shaples of orbitals.

2. CHEMICAL BONDING :

Overview of basic concept, Hydrogen bonding, Valence bond

theory, Hybridisation, VSEPR theory, Molecular orbital theory, Co-ordination bond, Crystal field theory for tetrahedral carbon.

3. CLASSIFICATION OF ELEMENTS :

Modern classification of elements (s,p,d and f blcok elements), Periodic properties : Ionisation potential electro negativity, Electron affinity, Born-Haber cycle.

4. INSTRUMENTAL METHODS :

UV-visible, IR and NMR spectroscopy, Basic principles, Beer-Lamberts Law and Application of spectroscopy.

5. ELECTRO CHEMISTRY :

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and it measurement by pH meter. Buffer solutions, Indicators, Solubility product, Common ion effect with their application, Redox reactions, Electrode potential(Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electro chemical series and its application.

Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell, Laclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkali stroge cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell), Numerical problems based on topics.

6. CHEMICAL KINETICS :

Introduction, order and molecularity of rection. Activation energy, Rate loss, rate constants, Ist order reactions and 2nd order reactions.

7. CATALYSIS :

Definition Characteristics of catalytic reactions, Catalytic promotors and poison , Autocatalysis and Negative catalysis, Actvation energy, Theory of catalysis, Application

8. SOLID STATE :

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. COLLOIDAL STATE OF MATTER :

Concept of collidal and its types, Different system of colloids, Dispersed phase and dispersion medium.
Methods of preparation of colloidal solutions, Dialysis and electrodialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobie colloids. Protection and protective colloids. Emulsion, Types, preparation,properties and uses. Application of colloids chemistry in different industries.

10. LUBRICANTS :

Definition, classification, Necessasity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compunds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

11. ENVIRONMENTAL POLLUTION AND ITS CONTROL :

Concept and various types of environmental pollution with special reference to air pollution and water pollution. General measures to control environmental pollution. depletion of Ozone layer, Green house effect, Acid rain, Smog formation, Chemical and photochemical reaction, Various species in atmosphere. Specific industrial pollution like Euro-I and Euro-II.

12. WATER TREATMENT :

Concept of hard and soft water, Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, Boiler feed water boiler scale formation, Corrosion, Caustic embritlement, primming and foarming.

Characteristics imparted by various impurities or contaminants such as colour, odour, taste and sediments and their analysis.

Analysis of Water :

A. Estimation of chlorides in water.
B. Determination of dissolved oxygen.

Disinfecting of Water :

By Chloramic, Ozone and Chlorination with its mechemism, Advantage and disadvantage of chlorinational, Break point chlorination (Free residual chlorination). Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Recycling of water-Theory and Process. Numerical problems based on topics.

13. CORROSION :

Concept of metallic corrosion, Types of corrosion and factors affecting the corrosion rate, Chemical and electrochemical theory of corrosion, Oxide film formation and its characteristics, tarnishing fogging and rusting, Prevention of corrosion by various methods.

14. FUELS :

Definition of fuel, its classification and their composition, Calorific value and determination of calorific value of solid and liquid fuels by Bomb calorimeter by Dulong's formula.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Disel and Petrol), Benzol and Power alchol.

Knocking, Anti-knocking agents, Octane number and Cetane number.

Cracking and its type, Gasoling from hydrogenation of coal (Bergius process and Fischer tropsch's process)

Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG, CNG and Solar energy

Numerical Problems based on topics

15. GLASS AND CERAMICS :

Concept of glass and its constitutents, Classification and uses of different glass, Elementary idea of manufacturing process of glass.Introduction to ceramics materials, Its constituent. Industrial application of glass and ceramic.

16. STEREOCHEMISTRY OF ORGANIC COMPOUND:

- Isomerism

- Types of isomerism

    1. Structural isomerism
    2. Steroisomerism (a) Geometrical (b) Optical

- Definition of chiral, achiral stereogenic centre, plane of symmetry.

- Types of steroisomers-

    1. Conformers or Rotamers (Only ethanes)
    2. Configurational isomers
        a. Enantiomers
        b. Diastereoisomers

17. ORGANIC REACTIONS :

1. Fundamental auspects -

   A. Regents electrophiles and nucleophiles
   B. Reaction Intermediates
      i. Free radical
      ii. Carbocation
      iii. Carbanion
   C. Various effects of substituents - Inductive, Mesomeric, Electromeric.

2.A. Mechanism of addition reaction (Markonicove's Rule, Cyanohydrin and Peroxide effect),

B. Mechanism of Substitution reactions (Nucleophillic-hydrolysis of alkyle halide, electrophillic substitution halogenation, Sulphonation, Niration and friedel-Craft reaction.

C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehyrohalogenation of primary alkyl halide.

18. ORGANIC MATERIALS :

A. POLYMERS :

1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight,Polymers, Polymerisation.

2. Characteristics of Polymers and their classification

   A. Addition polymers and their industrial application-Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.

   B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.

3. Free radical polymerisation (Mechanism)

4. General idea of Bio polymers

5. Brief idea of bio degradable polymers.
6. Inorganic polymers - Silicones

B. SOAPS AND DETERGENTS :

1. Introduction - A. Lipids, B. Fats and Oils
2. Saponification of fats and oils , Manufacturing of soap.
3. Synthetic detergents, types of detergents and its manufacturing.

C. EXPLOSIVES: TNT, RDX, Dynamite.
E. Paint and Varnish
F. Adhesives

LIST OF PRACTICAL

1. To analyse inorganic mixture for two acid and basic radicals from following radicals

A. Basic Radicals :

NH4+, Pb++, Cu++, Bi+++, Cd++, As+++, Sb+++,

Sn++, Al+++, Fe+++, Cr+++, Mn++, Zn++, Co++

Ni++, Ba++, Sr++, Ca++, Mg++

B. Acid Radicals :

CO3--, S--, SO3--, CH3COO-, NO2-,

No3- , Cl-, Br_ , I- , So4--

2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.

3. To determine the total hardness of water sample in terms of CaCo3 by EDTA titration method using E Br indicator.

4. To determine the strength of given HCl solution by NaOH solution using pH meter

5. To determine the Chloride content in supplied water sample by using Mohr's methods.

6. Determination method of temporary hard ness of water sample by O-hener's method.

1.5 ENGINEERING DRAWING

[Common to Three years Diploma Course in Civil Engg., Mechanical Engg., Chemical Engg., Dairy, Ceramic, Textile Technology, Textile Chemistry]

[Also Common to Four year Part-time Diploma Course in Electrical Engineering, Mechanical Engineering (Specilization in Production Engineering)]

[Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L	T	P
-	-	8

Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftmen and craftmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus, for the effective and efficient communication among all those involved in an industrial system, it becomes necessary that the perosonnel working in different capacities acquire appropriate skills in the use of this graphic language in varying degrees of proficiency in accordance with their job requirements.

Generally speaking, an engineering technician working at the middle level of the threetier technical manpower spectrum, is required to read and interpret the designs and drawings, providedto him by technologists and subsequently to translate them to the craftsmen for actual execution of the job.

This course in Engineering Drawing has been designed, keeping in view, the above refered job functions of a technician in the industry. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects. The contents of the course have been selected as to form a core for the various deversified fields of engineering. It is expected that at the end of this session, the students acqures sufficient skill drafting and some ability in spetial visualization of simple objects.

Sl.N.		Units	Coverage Time L	T	P
1.		Drawing Instruents and their use	-	-	4
2.	A.	Lettering techniques	-	-	8
	B.	Introduction to scales	-	-	8
3.		Conventional Presentation	-	-	8
4.		Principles of projections	-	-	16
5.		Orthographic projection of simple geometrical solids	-	-	24
6.		Section of Solids	-	-	20
7.		Isomatic Projection	-	-	20
8.		Free Hand Sketching	-	-	16
9.		Development of surfaces	-	-	24
10.		Assembly and dissembly drawing	-	-	24
11.		Orthographics Projection of Machine Parts	-	-	12

12.	Practice on Auto Cad	-	-	16
		-	-	200

C O N T E N T S

NOTE : Latest Indian Standards Code of Practice to be followed.

1. Drawing, instruments and their uses.

1.1 Introduction to various drawing, instruments. 1

1.2 Correct use and care of Instruments.
1.3 Sizes of drawing sheets and their layouts.

2. (a) Lettering Techniques 1 Sheet

Printing of vertical and inclined, normal single stroke capital letters.

Printing of vertical and inclined normal single stroke numbers.

Stencils and their use.

(b) Introduction to Scales 1 Sheet

Necesssity and use, R F

Types of scales used in general engineering drawing. Plane, diagonal and chord scales.

3. Conventional Presentaion : 2 Sheet

Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.

4. (a) Principles of Projection 1 Sheet

Orthographic, Pictorial and perspective.

Concept of horizontal and vertical planes.

Difference between I and III angle projections.

Dimensconing techniques.

(b) Projections of points, lines and planes. 1 Sheet

5 (a) Orthographic Projections of Simple 3 Sheet

Geometrical Solids

Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with referance planes.

(b) Orthographic views of simple composite solids from their isometric views.

(c) Exercises on missing surfaces and views

6. Section of Solids 1 Sheet

Concept of sectioning

Cases involving cutting plane parallel to one of the reference planes and prependicular to the others.

Cases involving cutting plane perpendicular to one of the reference planes and inclind to the others plane, true shape of the section

7. Isometric Projection. 2 Sheet

Isometric scale

Isometric projection of solids.

8. Free hand sketching 1 Sheet

Use of squared paper

Orthographic views of simple solids

Isometric views of simple job like

carpentary joints

9. Development of Surfaces 1 Sheet

Parallel line and radial line methods of developments.

Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).

10. Assembly and Disassembly Drawings 2 Sheet

Plummer block
Footstep bearings
Couplings etc.
Rivetted & Welded Joints

11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet

Nut and Bolt, Locking device, Wall bracket

12. PRACTICE ON AUTO CAD :

To draw geometrical figures using line, circle, arc, polygon, ellipse, rectangle - erase and other editing commonds and osnap commands (two dimensional drawing only)

NOTE :
The drawiang should include dimension with tolerence whereever necessary, material list according to I.S. code. 25% of the drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle figure

1.6 BASIC ELECTRICAL ENGINEERING

L	T	P
3	-	2

Rationale

An electrical diploma holder is involved in various jobs ranging from preventive maintenace of machines to fault location in circuits, commission of new machines to selection of suitable apparatus, designing of small components for improvement. In order to carry out these and similar jobs effectively on any equipment circuitry or machinery, specialised knowledge of concerned field is essential.

However, for acquiring knowldge in any specialised field of electrical engineering, a group of certain common fundamental concepts, principles and laws involved and mastering of some manual skills are pre-requisites. To be covered in the subject of basic electiricity.

Sl.N.	Units	Coverage Time L	T	P
1.	Basic terminology and their concept	4	-	-
2.	D.C. circuits	12	-	-
3.	Batteries	12	-	-
4.	Capacitors	12	-	-
5.	Electromagnetism	12	-	-
6.	Electromagnetic induction	12	-	-
7.	A.C. circuits	20	-	-
8.	Polyphase circuits	16	-	-
		75	-	50

DETAILED CONTENTS

1. Basic Terminology and their concepts

1.1 Current, EMF, potential difference (Voltage), resistance, resistivity their units conductors & insulators, Insulation resistance of a cable.

1.2 Effect of temperature on the resistance of conductors, semiconductors (C, Si, Ge) and insulators physical explanation, temperature coeffient of resistacne.

1.3 Electrical power, energy and their units (SI), Heating effect of electric current and its practical examples.

1.4 Relationship between electrical, mechanical and thermal SI units of work, power and energy, Electrical Safety and precautions.

2. D.C. Circuits

2.1 Kirchoff's laws.

2.2 Simple numerical problems based on Kirchoff's laws.

2.3 Introduction to Thevenin and Superposition theorem, Norton's theorem

3. Batteries

3.1 Construction, chemical changes during charging and discharging of lead acid cells.
3.1(a) Indications of a fully charged battery.
3.2 Capacity and efficiency of lead acid cell / battery.

3.3 Charging of 6 V., 12 V. commercial batteries.
3.3(a) Grouping of cells.
3.4 Care and maintenance of commercial batteries.
3.5 Problems/defects in lead acid betteries.
3.6 Concept of Nickel-Iron and Nickel Cadmimum Batteries.
3.7 Concept of solid sealed maintenance free batteries (SMF batteries), Oxygen recombiniation principle.

4. Capacitors

4.1 Concept of capacitor, types of capacity of parallel plate capacitor, Composite capacitor and effect of physical parameters.

4.1 Energy stored in a capacitor, dielectric and its influence on capaitance of a capacitor, dielectric constant dielectric breakdown and dielectric strength. Dielectric loss.

4.3 Series and parallel combination of capacitors.

4.3(a) Capacitance of multi-plate capacitors.

4.4 Variable capacitors.

4.5 Charging and discharging of capacitors.

4.6 Simple broblems on capacitors.

5. Electromagnetism

5.1 Concept of magnetic flux, flux density, magnetic field intensity ,permeability and their units.

5.2 Maganetic circuits, concept of reluctance and mmf and simple problems.

5.3 Analogy between electric and magnetic circuits.

5.4 B-H curve and magnetic hysteresis (No mathematiccal derivation).

5.5 Elementry ideas about hysteresis loss.

5.5(a) Lifting powers of a magnet.

6. Electromagnetic Induction

6.1 Faraday's laws of electromagnetic induction. Lenz's law, simple problem. Dynamically induced emf.
6.2 Self induced emf, inductance, its role in electrical circuits. Simple problems.
6.3 Mutually induced emf, mutual inductance,its role in electrical circuits. Simple problems.
6.4 Energy stored in magnetic circuit.
6.5 Rise and decay of current in inductors.
6.6 Force on a current carrying conductor placed in a magnetic field and its applications.
6.7 Elementry idea about eddy current loss.

7. A.C.Circuits

7.1 Recapitulation of terminology, instantaeous value, maximum (peak) value, cyle, frequency,alternate current and voltage. Difference between AC and DC.

7.2 Equation of an alternating voltage and current and wave shape varying sinusoidally.

7.3 Average and RMS value of alternating voltage and current. Importance of RMS value. Simple problems.

7.4 Concept of phase, phase difference and phasor representation of alternating voltage and current.

7.5. A.C. through pure resistance, inductance,capacitance, phasor diagram and power absorbed.

7.6 R-L series circuit, idea of impedance and calculations.

7.7 Apparent power, reactive power and active power,power factor, its importance and simple problems.

7.8 R-C series circuit , simple problems.

7.9 R-L-C series circuit , simple problems.

7.10 Solution of simple parallel A-C ciruits by

(a) Phasor diagram method,

(b) Admittance method.

7.11 Solution of AC circuits series/ parallel by j method. (simple problems).

7.12 Resonance (Series and parallel) and practical application, simple problems.

8. Polyphase System

8.1 Introduction to polyphase system. Advantage of three phase system over single phase system.

8.2 Star and Delta connections. Relationship between phase and line value of currents and voltage.Power in polyphase circuits. Simple problems of balanced circuits only.

BASIC ELECTRICAL ENGG. LAB

i) To show the variation of resistance of a lamp with temperature by plotting a V-I curve for 60W and 100W filament lamps.

ii) To verify the Kirchoff's laws.

iii) To observe the B-H curve for a ferro-magnetic core on CRO.

iv) To find the relationship between voltage and current for R-L series circuit for variable resistances & variable inductance.

v) To determine the variation in the values of inductance of a coil for different positions of the movable iron core.

vi) To measure the power factor in a single phase AC circuit by using voltameter, ammeter & wattmeter.

vii) To test a battery for charged and discharged condition and to charge a battery.

viii) Verification of voltage and current relations in Star and delta connected systems.

ix) To cahrge and discharge a capacitor and to show the graph on C.R.O.

x) Verification of laws of capacitors in series and parallel.

1.7 ELECTRICAL AND ELECTRONICS ENGG. MATERIALS

L	T	P
2	-	-

Rationale :

A diploma holder in electrical engineering will be involved in maintenance repair and production of electrical equipment and systems. In addition he may be required to procure, inspect and test electrical engineering materials. Knowledge of various types of materials will be needed in order to execute the above mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

Sl.No.	Units	Coverage Time L	T	P
1.	Classification	5	-	-
2.	Conducting materials	15	-	-
3.	Insulating materials	15	-	-
4.	Magnetic materials	5	-	-
5.	Semiconductor materials	5	-	-
6.	Special purpose materials	5	-	-
		50	-	-

DETAILED CONTENTS

1. Classification

Classification of materials into conducting, semiconducting and insulating materials with reference to their atomic structure.

2. Conducting Materials

(i) Resistivity and factors affecting resistivity, such as temperature, alloying and mechanical stressing.

(ii) Super conductivity and super conducting material.

(iii) Low resistivity materials e.g. copper, aluminium and steel, their general properties as conductor e.g. resistivity, temperature co-efficient,mechanical properties, corrosion, solor ability, contact resistance and practical application. Uses of mercury as conducting material.

(iv) Comparison of copper, aluminium and steel for various applications as electrical conductor.

(v) Low resistivity copper alloys: brass, bronze (cadmium and beryllium), their practical application.

(vi) High resistivity materials : manganin, constantan nichrome, carbon, tungsten, their practical applications.

(vii) Electric lamp materials.

(viii) Brush contact materials.

(ix) Soldering materials.

(x) Thermocouple materials, Fuse materials.

3. Insulating Materials

(i) Introduction.

(ii) Properties of insulating material.

- Electrical properties: Volume resistivity, Surface resistivity, Dielectric Loss, Dielectric Contant, Dielectric strength.

- Mechnical properties:- Mechanical strength
- Physical properties :- Hygrscoopcity tensile and compressive strength, Abrasive resistance brittleness.
- Thermal properties - Heat resistance, Classification according to high permissible temperature rise, Effect of over loading on the life of an electrical appliances, Increase in rating with the use of insulating materials having higher thermal stability,Thermal conductivity.
- Chemical properties - Solubility, Chemical resistance, Weather ability.

(iii) Insulating materials and their application-

- Definition and classification
- Thermo setting materials e.g. Phenol Formaldehyde, Resins (i.e. Backelite), Amino resins (Ureca formaldehyde and Malamine formaldehyde), Epoxy resins their properties, Applications and Commerical names.
- Thermo Plastic materials e.g. Polyvinyl Chloride (P.V.C.), Poly Ethelene Silicons their properties application and commerical names. Brief description of extrusion and moulding process of using plastic materials in electrical engineering.
- Natural Insutaling Materials- Mica and Mica products, Asbestos and Asbestos products, Ceramic materials (Porcelain and Stealite), Glass and glass products, Cotton, Silk, Jute, Paper (Dry and impregnated), Rubber Butuman, Mineral and insulating oil for transformer, switch gear, capactors, high voltage cables, insulating varnishes for coating and impregnation, Enamels for winding wires, Glass fibre sleeves

- Gasous Materials e.g. Air, Hydrogen, Nitrogen and SF6

4. Magnetic Materials :

(i) Classification of magnetic materials into soft and hard magnetic materials.

(ii) Soft magnetic materials - high silicon alloy steel for transformers and low silicon alloy steel, for electric rotating machine cold rolled grain oreinted and non-oriented steel, Nickel iron alloy, soft ferrites, their properties and uses.

(iii) Hard magnetic materials - tungsten steel,chrome steel, cobalt steel, alnico, hard ferrites, their properties and applications.

5. Semiconductor Materials

Introduction, semiconductor and their applications, Different semiconductor materials used in manufacturing various semiconductor (Si & Ge), Material used for electronic components like resister, capactor, diode, transistors and inductors.

6. Special Purpose Materials :

Materials used in transistor and IC manufacturing, PC BS, computer memory devices (name of such materials to be added)
Ferrous and non ferrous materials.
Thermistor, Sensistor, Varistor and therir practical applications.

1.8 ELECTRONICS - I

L	T	P
3	-	2

Rationale:

At present electronic gadgets are being extensively used in manufacturing processes in industries, power system operations and communication system, computers etc. Even for an electrical diploma holder it is absoluteby necessary to have a basic understanding of electronic components,circuits and devices like..

Sl.No.	Units	Coverage Time L	T	P
1.	Semiconductor diode	9	-	-
2.	Bipolar Junction transistor	9	-	-
3.	Single stage transistor amplifier	9	-	-
4.	FET MOSFET & CMOS	9	-	-
5.	Multi Stage & Power amplifier	12	-	-
6.	Feedback amplifiers	9	-	-
7.	Regulated power supply	9	-	-
8.	Oscillator	9	-	-
		75	-	50

1. Semiconductor Diodes

Semiconductor materials N type and P Type P.N. junction, its forward and reversed biasing; junction diode characteristics, static and dynamic resistances and their calculation from diode characteristics.

Diode (P-N junction) as , half wave, full wave rectifier including bridge rectifier, relationship between D.C. output voltage and A.C. input voltage, rectification efficiency and ripple factor for rectifier circuits, filter circuits, shunt capacitor, series inductor, capacitor input filter, bleeder resistance, physical explanations of the working of the filters and typical applications of each type. Basic idea of three-phase rectifier.

Different types of diodes, brief idea of characteristics and typical applications of power diodes, zener diodes, varactor diodes, point contact diode, tunnel diodes, LEDs and photo diodes.

Important specifications of rectifier diode and zener diode.

2. Bipolar Junction Transistor :

A. Concept of bipolar junction transistor as a two junction three terminal device having two kinds of charge carriers, PNP and NPN transistor,s their symbols and mechanisms of current flow, explanation fundamental current relations. Concept of leakage current (I cbo) effect of temperature on

leakage current.

Standard notation for current and voltage polarity; CB, CE, and CC configurations. Transistor input and output characterstics, concept of active, cut off and saturation region.

Common emitter configuration: current relations in CE configuration, collector current interms of base current and leakage current (Iceo), relationship between the leakage current in CB and CE configuration, ;input and output characterstics, determination of dynamic input and output resistances and current amplification factor from the characterstics.

B. Basic Transistor Amplifier,Biasing & Stablization ;

Transistor as an amplifier in CE configuraion.

(a) DC load line, its equation and drawing it on collector characterstics;

(b) Determination of small signal voltage and current gain of a basic transistor amplifier using CE output characterstic and DC load line, concept of power gain as a product of voltage gain and current gain.

Operating point, effect of temperature and V on operating point, need for stabilizaion of operating point. Effect of fixing operating point in cut-off saturation region on performance of and amplifer. Potential divider biasing circuit for biasing stabilisation.

(c) Classification of amplifiers according to their frequency range methods of operation, the ultimate use the type of load and method of interstage coupling.

3. Single Stage Transistor Amplifier

Single stage CE amplifier with proper biasing circuit and its working as voltage amplifier. AC load line and its use in:

(a) Calculation of current and voltage gain of a single-stage amplifier circuit.

(b) Explanation of phase reversal of the output voltage with respect to input voltage. Introduction to tuned voltage amplifier.

4. FIELD EFFECT TRANSISTOR (FET), MOSFET & CMOS

4.1 Construction, operation, characteristics and Biasing of Junction FET, MOSFET and CMOS.

4.2 Comparison of JEET, MOSFET and Bipolar transistor.

5. MULTISTAGE & POWER AMPLIFIERS:

5.1 Need of multistage amplifier, different coupling schemes and their working, brief mention of application of each of the type of coupling.

5.2 Working of R.C. coupled and transformer coupled multistage amplifier, approximate calculation of voltage gain and frequency response for a two stage R-C coupled amplifier.

5.3 Importance of impedance matching in power amplifier collector efficiency of power amplifiers. Heat dissipation curve and importance of heat sinks,collector efficiency and distortion in class A, class B and class C amplifier (without derivation) working principles of push pull amplifier circuits its advantages over single ended power amplifer.

6. Feedback in Amplifiers

Basic principles and types of feedback, derivation of expression for the gain of an amplifier employing feedback. Effect of negative feedback on gain,. stability, distortion, and band width.(only physical explanation) typical feedback circuits:

(a) RC coupled amplifiers with emitter by-pass capacitor removed.

(b) Emitter follower, coumplementry symetry power amplifier and its applications.

7. Regulated Power Supply

7.1 Concept of regulation.

7.2 Basic regulator circuits (using zener diode).

7.3 Concept of series and shunt regulator circuits.

7.4 Three terminal voltage regulator Ics (positive negative and variable) application. Block diagram, Pin configuration and working of popular regulator IC.

8. OSCILLATORS:

8.1 Application of oscillators.

8.2 Use of positive feedback/negative resistance for generation of oscillation, barkhawn's criterion for oscillations.

8.3 Different oscillators circuits, tuned collector, Hartley, colpitts, phase shift, Wien's bridge and crystal oscillator and their working principles (no mathematical derivation).

8.4 Mention of at least one polular IC with its block diagram, Pin configuration and it working of each type of oscillators.

ELECTRONICS I LAB:

1. Semiconductor diode : identification of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (germaniun, point contact, silicon low power and high power and switching diode).

2. Rectifier circuits using semiconductor diode measure- ment of input and output voltage and ploting of input and output waveshapes:

   i) Half wave rectifier
   ii) Full wave rectifier (centre tapped and bridge rectifer circuits).

3. Plot the waveshapes of a full wave rectifier with shunt capacitor, series inductor, and filter circuit

4. Transistor Biasing Circuits

   Measurment of operating point (IC and VCF) for a

   i) Fixed bias circuit
   ii) Potential divider biasing circuit.

   (Measurement can be made by changing the transistor in the circuit(s) by another of same type number.

5. Single stage common emitter amplifier circuit

   i) Measurement of voltage gain at 1 KHZ for differnet load resistances.
   ii) Plotting of frequency response of a single stage amplifier circuit.
   iii) Measurement of input and output impedance of the amplifier circuit.

6. To measure the overall gain of two stage R.C coupled amplifier at 1 KHZ and note the effect of loading of second stage on the first stage.

7.(a) To plot the laod Vs output power characterstic to determine the maximum signal input for undistorted signal output.

(b) The above experiment is to be performed with single ended power amplifier, transistorized push pull amplifier. Complementary symetry power amplifier.

8. To observe the effect of a bye-pass capacitor by measuring voltage gain and plotting frequency response for a single stage amplifier.

9. To measure input and output impedance of a feedback amplifier with and without by-pass capacitor.

10. Measurement of voltage gain, input and output impedance and plotting of frequency response of an emitter follower circuit.

11 Plot the FET characteristics and determination of its parameters from these characteristics.

12. To determine the range of frequency variation of a RC phase shift oscillator.

13. To test adjustable IC regulator and current regulator.

14. Identification of Some Popular IC of 74 and 40 series with Pin Number and other details.

15. Application and use of Multimeter, CRO, Audio Oscillator and Power Supply (D.C.)

1.9 WORKSHOP PRACTICE

[Common with Civil Engg., Civil Engg. (sp. in Rural Engg.), Mechanical, Ceramic, Dairy, Agriculture, Chemical Technology (Rubber & Plastic), Chemical Technology (fertilizer), Four year chemical Engg.]

[Four year Past time Mechanical Engg. (sp. in Production Engg.)]

L	T	P
-	-	8

Rationale

A diploma holder in any branch of engineering has to work in between a skilled workman and an Engineer. In order to have effective control over skilled workmen it is necessary that the supervisory staff must have adequate knowledge and skill. For development of skills workshop practice is very essential.

Sl.No.	Units	Coverage L	T	Time P
1.	Carpentry shop	-	-	24
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and sodering shop	-	-	24
4.	Fitting shop	-	-	24
5 A.	Plumbing shop	-	-	16
5 B.	Foundry shop			20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
9.	Fastening Shop	-	-	12
		-	-	200

DETAILED CONTENTS

1. Carpentry Shop :
   - EX-1 Introduction & demonstration of tools used in carpentry shop
   - EX-2 Planing and sawing practice
   - EX-3 Making of lap joint
   - EX-4 Making of mortise and tenon joint
   - Ex-5 Making of briddle joint
   - EX-6 Making of dovetail joint
   - Ex-7 Making of any one utility article such as wooden-picture frame, hanger, peg, name plate, etc.

2. Painting and Polishing Shop:

   EX-1 To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other

side.

Ex-2 To prepare metal surface for painting, apply primer and paint the same.

EX-3 To prepare a metal surface for spray painting,first spray primer and paint the same by spray painting gun and compressor system.

* EX-4 Buffing and abressive polishing of brass job.

Ex-5 Zinc coating by electroplating method.

Ex-6 To prepare any utility job.

* The sequence of polishing will be as below:

i) Abrassive cutting by leather wheel.

ii) Pollishing with hard cotton wheel and with polishing material.

iii) Buffing with cotton wheel or buff wheel.

3. Sheet Metal Working and Soldering Shop :

EX-1 Introduction & demonstration of tools used in Sheet metal working shop.

EX-2 Cutting, shearing and bending of sheet.

EX-3 To prepare a soap case by the metal sheet.

EX-4 To make a funnel with thin sheet and to solder the seam of the same.

EX-5 To make a cylinder and to solder the same.

EX-6 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.

EX-7 Study and sketch of various types of stakes/anvil.

EX-8 To braze small tube/conduit joints.

4. Fitting Shop :

EX-1 Introduction & demonstration of tools used in Fitting Shop.

EX-2 Hacksawing and chipping of M.S. flat.

EX-3 Filing and squaring of chipped M.S. job.

EX-4 Filing on square or rectangular M.S. piece.

EX-5 Making bolt & nut by tap and die set.

Ex-6 To drill a hole in M.S. Plate and taping the same to creat threads as per need.

EX-7 Utility article-to prepare a screw driver or paper weight, double open mouth spanner for 18" hexagonal head of a bolt.

5 A. Plumbing Shop :

EX-1 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.

EX-2 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.

5 B. Foundry Work

Ex-1 Study & sketch of the foundry tools.

Ex-2 Study & sketch of cupula & pit furnace.

Ex-3 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep

mould)

Ex-4 Casting of non ferous (lead or aluminium) as per exercise 3.

6. Smithy Shop :

EX-1 Study & Sketch of Tools used in smithy shop.
EX-1 To prepare square or rectangular piece by the M.S. rod.
EX-2 To braze M.S. Flats/Tipped tools on M.S. shank.
EX-3 To make a screw driver with metalic handle.
EX-4 To make a square or hexogonalhead bolt.
EX-5 To make a ring with hook for wooden doors.
EX-6 Utility article-to preapre a ceiling fan hook.

7. Welding Shop :

EX-1 Welding practice-gas and electric.
EX-2 Welding for lap joint after preparing the edge.
EX-3 Welding of Butt joint after preparation of the edge.
EX-4 'T' joint welding after preparation of edge.
EX-5 Spot welding, by spot welding machine.
EX-6 Welding of plastic pieces by hot strip method.
EX-7 Welding practice by CO2 gas welding

8. Machine Shop

EX-1 Study & sketch of lathe machine.
Ex-2 Plain and step turning & knurling practice.
Ex-3 Study and sketch of planning/Shaping machine and to plane a Ractangle of cast iron.

9. Fastening Shop

EX-1 Practice of bolted joints
EX-2 To prepare a rivetted joint
EX-3 To make a pipe joint
EX-4 To make a threaded joint
EX-5 Practice of sleeve joint

2.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
3	1	-

Rationale :

The study of mathematics is an important requirement for the understanding and development of concepts of Engg.The purpose of teaching mathematics to the Diploma Engg. students is to give them basic foundation and understanding of mathematics so that they can use the same for the understanding of engineering subjects and their advancements.

Sl.No.	Units	Coverage Time L	T	P
1.	Matrices	15	5	-
2.	Ordinary Differential Equations	15	5	-
3.	Differential Calculus-II	15	5	-
4.	Integral Calculus-II	15	5	-
5.	Probability & Statistics	15	5	-
		75	25	-

DETAILED CONTENTS

1. MATRICES :

1.1 Algebra of Matrices, Inverse :

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Determinant of a matrix, Cofactors, Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation :

Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix :

Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vactors,Consistency of equations.

1.4 Types of Matrices :

Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular.

1.5 Eign Pairs, Cayley-Hamilton Theorem :

Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. ORDINARY DIFFERENTIAL EQUATION :

2.1 Formation, Order, Degree, Types, Solution :

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree and Meaning of solution of a differential equation, Linear, Nonlinear equation.

2.2 First Order Equations :

Variable seperable, equations reducible to seperable forms, Linear and Bernoulli form exact equation and their solutions.

2.3 Second Order Linear Equation :

Property of solution, Linear equation with constant coefficients, canchy type equation. Homogeneous and Non-homogeneous equations, equations reducible to linear form with constant coefficients.

2.4 Simple Applications :

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

$z=x^2 + y^2$, $x^2 + y^2 = a^2$, $x + y = 2$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1 \qquad \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

3.2 Partial Derivatives :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Eulens theorem for homogeneous functions, Jacobians.

3.3 Vector Calculus :

Vector function, derivatives, gradient, divergence and curl

Some indentities among these.Five integrals, double and triple integral, surface integral, Grean, Gauss and stokes theorem and application

4. INTEGRAL CALCULUS - II

4.1 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, Solution of ordinary differential equations.

4.2 Beta and Gamma Functions :

Definition, Use, Relation between the two, their use in evaluating integrals.

4.3 Fourier Series :

Fourier series of f(n)-n<x<n, Odd and even function, Meaning of the sum of the series at various pairs.

5. PROBABILITY AND STATISTICS :

5.1 Probability :

Laws and Conditional probability

5.2 Distribution :

Discrete and continuous distribution.

5.3 Binomial Distribution :

Properties and application through problems.

5.4 Poisson Distribution :

Properties and application through problems

5.5 Normal Distribution :

Properties and applications through problems

5.6 Method of Lease-quare.

2.2 ELECTRONICS - II

L	T	P
3	-	3

Rationale

The purpose of introducing Electronics II in electrical engineering is to provide basic knowledge of digital electronics, microprocessors, and communication Engineering in accordance with the need of modern technological advancements. Electronics has become an integral part of control system engineering. Electronic control devices are robust cheap, less power consuming and safe. An electrical engineering diploma passout reinforced with general idea in electronics will be more useful to the industries.

Sl.No.	Units	Coverage Time L	T	P
1.	Digital electronics	20	-	-
2.	Operational amplifiers	15	-	-
3.	Microprocessors	15	-	-
4.	Communication engg.	15	-	-
5.	Integrated Circuits	10	-	-
		75	-	75

DETAILED CONTENTS

1. Digital Electronics :

(I) Introduction - Basic difference between analog and digital signal; Advatages of digital system and its field of applications.

(ii) Number system - Binary, Decimal, Octal and Hexadicimal and their need.

(iii)A. Logic Gates - Symbol and truth tables of AND, OR NOT, NAND, NOR and EX-OR gates.
Boolean theorems and postulates (without proof) Realisation of small Boolean functions and reduction using Karnaugh's map upto 3 variables using logic gates and vice-versa.

B. Logic Faimilies- TTL, CMOS, MOS, ECL, DTL, HTL, IIL.

(iv) Half Adder and full adder circuits and their operations,Display Devices.

(v) Encoder, Decoder, Multiplexer and Demultiplexer.

(vi) Need of Flip-Flops, Detail idea of counters and (Synchronous and Asynchronous) and resister with purpose. Idea of astable, monostable, bistable multivibrators.

(vii) A/D and D/A conversion.

2. Operational Amplifiers

Specifications of ideal operational amplifier and its block diagram as an inverter, scale changer, adder, subtractor, differential amplifier, buffer amplifier, differentiator integrator, schmitt trigger and log and antilog amplifiers.

3. Microprocessors

(i) Microprocessors and its need in modern technology.

(ii) Functional block diagram of microprocessors and function of its various blocks with reference to 8085 microprocessors. Brief Introduction to 8086 micrporcessor and its application. Assembly language programming with 8085 and 8086.

(iii) Different other types of microprocessor and application. (8255, 8253, 8257, 8259, 8279)

4. Communication Engineering

(i) Basic block diagram of a modern communication system and its working.

(ii) Concept of modulation its need and types.

(iii) Concept of demodulation its need and types.

(iv) Concept of a receiver/transmetter and its functional requirments.

(v) Introduction to digital and data communication.

(vi) Introduction to modern ways of communciation- Brief idea of optical Fibre communication, Microwave communication, Satelite communication and Mobile communication.

5. INTEGRATED CIRCUITS

5.1 Introduction to IC and its importance in modern electronics, types of IC's, some examples of populer IC's (74 & 40 series i.e. 741, 714, 555, 810, 4046 etc.).

5.2 Difference between SSI, MSI, LSI, VLSI.

NOTE :

Only brief idea of above topics should be given.

ELECTRONICS II LAB

A - Digital Electronics

10 experiments are to be performed atleast 4 from each group .

1. Familiarisation with bread-board.

   Familiarisation with TTL and MOS ICs.

2. Identification of IC-Nos, pin nos, IC types.

3. To observe that logic low and logic high do not have same voltage value in INPUT and OUTPUT of a logic gate.
4. To observe the propagation delay of TTL logic gate.
5. Observation of differences between MOS and TTL gates under the following heads:

   (a) Logic levels
   (b) Operating voltages.
   (c) Propagation delay.

6. Use of Op-Amp.(for IC 741) as inverting and noninverting amplifier, adder, comparator, buffer, scale changer.
7. Use of IC 755 as timer.

   Display Devices and Associated Circuits

8. Familiarisation and use of different types of LEDs common anode and common cathode seven segment display

   Logic Gates

9. Verification of truth tables for 2 Input NOT, AND, OR NAND,NOR, XOR GATES.

10. To construct half adder and half subtractor using XOR and NAND gates verification of their truth tables.

11. To construct a full adder circuit with XOR and NAND gates.

    (a) Study of 3 bit adder circuit implemented with OR and NAND gates.

    (b) To construct 4 bit adder and full subtractor using full adder chip 7480 and NAND GATES.

12. (a) To verify the truth table of 4 bit adder IC chip 7483.

(b) To construct the 4-bit adder/2 complement subtractor using 7483 and NAND gates.

12. Flip Flops

To verify the truth table for selected positive edge triggered and negative edge triggered F/F of J-K and D type.

13. Counters

To construct and verify truth table for asynchronous bin and decade couter using J-K flip flops.

(a) To construct divide by 60 counter using ripple counter IC Chips.

(b) To use counter IC chip 7493 in the divided by eight mode and divide by sixteen mode.

(c) To construct a divide by 100 counter using CMOS

To construct a divide by 60 counter using synchronous counter IC chips.

14. Registers

To construct a 4 bit buffer register using 4 bit register IC chips.

To construct a 4 bit universal shift register using flip flops.

To use a 4035 B universal shift resgister.

B- Microprocessor ;

1. Familiarization with 8085 and 8088 Trainer.

2. Add two 8 bit numbers.

3. a) Obtain 2's complement of 8-bit numbers.
   b) Subtraction of two numbers using 2's complement.

4. Extract fifth bit of a number in A and store it in another register.

5. Count No. of bits in high state in accumulator.

6. Check even parity and odd parity.

7. a) Add two 16-bit numbers by repetitive addition.
   b) Divide two 8-bit numbers by repetitive sub-traction.

8. a) Smallest number of three digits.
   b) Largest number of three digits.

9. Arrange numbers in ascending order.

10. Write a program to find out sum of first n-multiplier of a number.

11 . Arrange number in descending order.

15. Use of Op-Amp. (for IC-741) as Inverting and non-inverting amplifier, adder, comparator, buffer, scale changer.

NOTE :

Every Student should Fabricate a Mini Project based on Solid State Device.

2.3 ELECTRICAL DESIGN, DRAWING & ESTIMATING-I

L	T	P
4	-	4

Rationale

A diploma holder in Electrical Engineering is supposed to have basic idea of the design of small gagets such as heater coil, miniature transformer etc. He must also have the knowledge of interpreting engineering drawing, reading of blue prints, preparation of estimates for domestic and power wiring, transmission and distribution lines, errection and design of poles and towers and other electrical equipments and accessaries. The paper Electrical Design Drawing and Estimating I will provide elementary knowledge about some of the above things.

Sl.No.	Units	Coverage Time L	T	D	P
1.	Electrical symbols and diagrams	12	-		12
2.	Wiring materials and accessaries	12	-		12
3.	Light and fan circuits	12	-		12
4.	Alarm circuits	12	-		12
5.	Internal wiring	12	-		12
6.	Assembly drawings	16	-		12
7.	Electrical design	12	-		12
8.	Armature winding of D.C.m/cs	12	-		16
		100	-		100

Electrical Symbols and Diagrams :

(i) Need of symbols; List of symbols for electrical equipments and accessaries used in electrical light, fan and power circuits, alarm and indicating circuit , contactor control circuits as per I.S.S.

(ii) Type of diagrams - Wiring diagrams (multiple and single line representation) and schematic diagrams as per I.S.S.

* One Drawing Sheet for atleast - 50 symbols.

2. Wiring materials and acessaries :

(1) Brief description, general specifications (as per I.S.S.) and approximate cost of different types of wires, cables, switches, distribution board, switch board, boxes, batten and its accessaries, conduit and its accessaries, lamp holders, socket out lets, plug ceiling roses. fuse amd energy meter used in domestic and power wiring installations.

(ii) Brief description, general specifications and approximate cost of switches,push buttons, bells, indicating lights, indicating panels,

relays etc.used in alarm circuits.

* Study of materials and accessaries in work shop.

3. Light and Fan Circuits :

Schematic and wiring diagrams (multiline and single line both) using junction boxes and looping systems for the following types of circuits:-

(i) Light and fan controlled by necessary switches and regulators.

(ii) Stair case wiring

(iii) Corridor lighting

(iv) One lamp controlled by three or more switches.

* One drawing sheet for atleast 4- problems.

* Wiring practice for atleast 3-circuits.

4. Alarm Circuits:

Reading, designing and drawing schematic and wiring diagrams (multiline and single line) of following alarm circuits:-

(i) Circuits meant to convey information by means of light only.

(ii) Circuits meant to convey information by means of bell signals only. (One bell controled by one push button switch, Bell responds circuits using one bell and relay, Bell responds circuits of an office or three rooms)

(iii) Circuits meant to convey information by means of bell and light both for call signals.

(iv) Circuits meant to convey information by means of bell and light to give 'stop' and 'go' signals.

(v) Traffic control light system for 2 road crossing

(vi) A light circuit with gets automatically connected to DC supply in case of power failure.

* 8-Drawing sheets for atleast 6-problems of each type.
* Wiring practice for atleast - 2-circuits of each type.

5. Estimation of Domestic Internal Wiring Circuits : (Small Houses)

(i) Description of various wiring systems and methods.

(ii) Need of earthing and point to be earthed in internal wiring system as per IE rules.

(iii) I.S. specifications, calculation of No. of points (light, fan, socket outlet), calculation of total load including domestic power, determination of no. of circuits, size of wires and cables, switches and mainswitch, distribution board and switch board, batten conduit and other wiring accessaries.

(iv) Layout of installation plan, single line wiring, diagram, calculation of length of batten/conduit of differant sizes and wire length; schedule of materials.

(v) Estimating for small houses using PWD/CPWD electrical schedule rates (E.S.R.)

* The drawing sheet for atleast 4-layouts and circuits

* Estimation practice for atleast - 2 installations each for small houses.

6. Assembly Drawings:-

(i) Assembly drawing of simple electrical equipment from actual piece or from a pictorial view (carbon brush holder, open knife switch, miniature circuit breaker, motor terminal block, and similar other electrical items).

* 2-Drawing sheets

(ii) Poles, towers cables and instulators

* 2- Drawing sheets

7. Electrical Design :

Design of small transformers upt 1 KVA and chokes, heaters.
Transformer connections and bushing. 2 sheet

8. Armature Winding of D.C.Machines:

Definition of terms used in winding, simple 2 Sheet
Lap and Wave winding exercises for d.c.motor
and generator.

ELECTRICAL WIRING & FABRICATION SHOP

1. To prepare a folder/display board of accessaries used in domestic wiring with complete specifications.

2. To prepare a display board of tools used in wiring and fabrication shop.

3. Batten wiring containing light, ceiling fan, socket points.

4. Staircase wiring using two way switches.

5. Connection of a flourescent tube using starter, choke and single way switch and its fault detection.

6. Practice of domestic conduit wiring.

7. Testing of wiring instalation by meggar.

8. Connection of mercury lamp along with accessaries.

9. Making of an extension board containing two 5 A and 15 Amp plug points controlled by individual switches using MCB/ELCB (Earth Leakage Circuit Braker).

2.4 ELECTRICAL INSTRUMENTS AND MEASUREMENTS

L	T	P
2	1	2

Rationale:

Diploma holding technician has to work on various jobs in field as well as in testing laboratories and on control panels, where he performs the duties of installation, operation, maintenance and testing of measuring instruments. Technician working on control panels in power plants, substations and in industries will come accross by use of various types of instruments and has to take measurements.

Instruments used to read the general electrical quantities like curent, voltage power, energy, frequency, and resistance have been incorporated in this subject. So the technician will know the construction and use of various types of instruments.

Sl.N.	Units	Coverage Time L	T	P
1.	Introduction	2	1	-
2.	Measurements & errors	2	1	-
3.	Ammeters and voltmeters	6	3	-
4.	Wattmeter and maximum demand indicater	6	3	-
5.	Energymeter	4	2	-
6.	Miscellaneous measuring instruments	6	3	-
7.	Electronic instruments	8	4	-
8.	Measurement of inductance and capacitance	8	4	-
9.	Elements of process instrumentation	8	4	-
		50	25	50

DETAILED CONTENTS

1 Introduction to electrical measuring instruments:

1.1 Concept of measurement and instruments.

1.2 Electrical quantities and instruments for their measurements.

2.1 Measurement and Errors. Accuracy, precision, types of errors, probability of errors and Gaussian Errors curve, sensitivity, resolution and stability. Classification of errors.

2.2 Types of electrical measuring instruments, indicating, integrating and recording instruments.

2.3 Essentials of indicating instruments , deflecting,

controlling and damping torques.

2.4 Measurement of dielectric strength of insulating oil and dielectric loss.

3. Ammeters and voltmeters (moving coil and moving iron type)

3.1 Concept of ammeters and voltmeters and difference between them.

3.2 Construction and working principle of moving coil and moving iron instruments.

3.3 Merits and demerits, sources of errors and application of these instruments.

3.4 Extension of range, use of C.T. & P.T. simple problems thereon for d.c. circuits.

4. Wattmeters (Dynamometer type) and Maximum Demand Indicator:

4.1 Construction, working principle, merits and demerits of dynamometer type wattmeter.

4.2 Sources of errors.

4.3 Power measurement in three phase circuit by Two wattmeter and three wattmeter methods, simple problems.

4.4 Construction and working principle of maximum demand indicators.

5. Energymeter (Induction type):

5.1 Construction, working principle, merits and demerits of single-phase and three phase energy meters.

5.2 Testing of energy meters for calibration. Errors and compensation. Simple problems.

5.3 Digital Energy meter (Single Phase/Three Phase) Construction working and application

5.4 Trivector Meter, Construction, Working & Its Application.

6. Miscellaneous Measuring Instruments:

The construction, working principle and application of: ohm-meter, meggar, earth tester, multimeter, frequency meter (reed-type) single phase power factor meter (Electrodynamometer type), 3-phase power factor meter, phase sequence indicator, synchronoscope. Trivector meter-Construction, Working and application.

7. Electronic Instruments:

7.1 Cathode Ray Oscilloscope, construction, working of various controls of CRO. Simple applications (like measurement of voltage current and frequency).

7.2 Introduction to electronic multimeter, analog multimeter , digital multimeters and V.T.V.M.

8. Measurement of Resistance Inductance and Capacitance

8.1 Bridges : Maxwell bridge, Wein's bridge and Schering bridge.

8.2 Potentiometer, Kelvin's double bridge.

9. Elements of Process Instrumentation

9.1 Block diagram of process instrumentation system and purpose of each block.

9.2 Basic principles of various sensors/transducers for measurement of temperature, pressure, strain and liquid level.

(i) To extend the range of an ammeter/voltmeter.

(ii) To convert an ammeter into voltmeter.

(iii) To calibrate 1-phase energymeter by direct loading method.

iv) To make proper connections of indicating/integrating instruments in a circuit e.g. wattmeter, frequency meter, power factor meter, 1-phase and 3-phase energy meter (Analog type/Digital Type) etc.

(v) To measure power, power factor in a l-phase circuit using wattmeter and power factor meter and verify results with calculations.

(vi) Measurement of power and power factor of a 3-phase balanced load by 2-wattmeter method.

(vii) Measurement of voltage, frequency of a sinusoidal signal with C.R.O.

(viii) Measurement of resistance, voltage, current with electronic multimeters (Analog & Digital) and compare the reading.

(ix) To measure strain by transducer.

(x) To measure inductance by maxwell's bridge.

(xi) To measure capacitance by Wein's/Schering bridge.

(xii) To calibrate three phase energy meter with the help of standard 3 phase energy meter.

(xiii) To connect a Trivector meter in a three phase circuit and make measurement of different quantities.

2.5 ELEMENTARY MECH. & CIVIL ENGG.

L	T	P
3	-	2

Rationale

Apart from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementry Mech. & Civil Engg. to impart some necessary knowledge and skill about civil and mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical technician is intermingled with either civil or mechanical engineering. As such the relevant basic topics of these disciplines are included in the content of the subject.

Some study exercises along with some field work have been suggested to give feel of jobs and equipments involved.

Sl.No.	Units	Coverage Time L	T	P
1.	Applied mechanics	10	-	-
2.	Strength of material & power transmission	10	-	-
3.	Hydraulics and hydraulic machines	10	-	-
4.	Heat engines	10	-	-
5.	Civil engineering materials	10	-	-
6.	Foundation	10	-	-
7.	Surveying	15	-	-
		75	-	50

DETAILED CONTENTS

1. Applied Mechanics

General condition of equilibrium of a rigid body under coplaner forces. Concept of tie, strut, beam and trusses. Shear force and bending moment diagram of simply supported beam and cantilever for point load. Concept of centre of gravity, moment of inertia and friction. Mechanical advantage, velocity ratio, mechanical efficiency of simple machines: Lifting machines much as pulley, differential pulley, wheel and axle, simple screw jack, worm and worm wheel.

2. Strength of Materials & Power Transmission:

Stress, strain, elastic constraints, stress in circular shaft subjected to pure torsion only. Rivetted and bolted joints. Power transmission by solid and hollow shaft. Gear trains - simple and compound, fly wheel. Rope and belts - velocity ratio,

length, size of belt and power transmited.

3. Hydraulics & Hydraulic Machines:

Properties of fluids, pressure of fluid and its measurement. Flow of fluids velocity and discharge, Bernaulli's theorem and its application in venturimeter, flow through pipe, head loss due to friction. water turbines- Pelton and Reaction, reciprocating and centrifugal pump.

4. Heat Engines:

External & internal combustion engines, working of diesel and petrol engine, horse power of IC engines, steam generator, constrcution and working of Bobcock & Wilcox boiler, Cochran boiler, condenser, steam turbine classifcation and principle of operation, gas turbine.

5. Civil Engineering Materials:

General idea of raw materials, manufacturing process, properties and uses of Bricks, lime, cement and Timber.

6. Foundation

(i) Bearing capacity of soil and its importance, need of foundation for electrical machines.

(ii) Foundations for heavy, light and vibrating machines.

(iii) Concrete proportion, mixing w/c ratio, workability RCC and its use.

7. Surveying

(i) Basics of chaining and leveling

(ii) Description of Instruments used

ELEMENTRY MECH. & CIVIL ENGG. LAB.

Part I :(Mechanical Engineering Laboratory/Hydraulics laboratory

(i) To operate a diesel engine (starting, running and shutting down) and to study lubricating and cooling system of the engine.

(ii) To determine BHP of diesel or petrol engine and show that BHP is directly proportional to revolution per minute of engine shaft.

(iii) To determine mechanical advantage, velocity ratio, efficiency and effort loss due to friction in screw jack.

(iv) To verify Bernoulli's theorem with the help of Bernoulli's appratus.

(v) To determine head loss due to friction in GI pipes.

(vi) To operate the Pelton wheel and Francis Turbine and to understand its construction and working.

(vii) To perform tensile test on mild steel and aluminium wire specimen and compare the result.

(viii) To do alignement and coupling of a motor generator set.

Part II: (Civil Engineering Laboratory):

(i) Chain survey of a small area
- (a) Ranging a line
- (b) Chaining a line
- (c) Taking offset on the chain line and recording the field book.

(ii) Leveling

- (a) To find the difference in level between several points by single setting by the use of dumpy level.
- (b) To find the difference in level between two distant points by (i) Rise & Fall method, (ii) Line of collimation method.

Models:

1. Cut section models of turbine, pumps.
2. Cut section models boilers, condensers.
3. Cut section models of diesel and petrol engines.
4. Models showing power transmission by, rope, belt, chain and gears.
5. Models of clutch and brakes, shaft conpling.
6. Model of chain pulley block and three systems of pulleys.

2.6 COMPUTER APLICATION FOR ENGINEERING

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg.,(Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg.,Instumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Cermics, Chemical Engg.(Four year Sandwitch), Chemical Tech. (Rubber & Plastic), Chemical Tech. (Fertilizer)]

L	T	P
1	-	3

Rationale:

Computers are being used for design and information processing in all branches of engineering. An exposure to fundamentals of computer programming is very essential for all diploma holders. this subject has been included to introduce students in the use and application of computers in engineering.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction to Computer	5	-	-
2.	Introduction To Operating System MS DOS/Windows	3	-	-
3.	Ms-Word	4	-	-
4.	Ms-Excel	3	-	-
5.	Ms-Power Point	3	-	-
6.	Ms-Access	3	-	-
7.	Introduction to Internet	2	-	-
8.	Concept of Programming	2	-	-
		25	-	75

DETAILED CONTENTS

1. Introduction to Computer:

Block Diagram of Computer, Types Of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disk drive, CD-ROM Drive, Magnetic & Tape Drive

Number system(Conversion) Binary, Octal, Hexa decimal number system,Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)

What is operating system, its significance, Commands of DOS, Features/Application of window.

3. MS WORD:

File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup
Edit : Cut, Copy,Paste, Office Clipboard, Select All, Find, replace, Goto, etc.
View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc.
Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc.
Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc.
Tools : Spelling & Grammer, Language, Word Count, Letters & Mailing, Options, Customize, etc.
Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

4. MS EXCEL:

Introduction, Use of Tools/Icons for preparing simple applications.

5. MS POWER POINT :

Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. MS ACCESS :

Introduction, Use of Tools/Icons for preparing simple applications.

7. Introduction to Internet:

What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating Mail ID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming :

Flowcharting, Algorithm techniques, etc.

List Of Practicals

1. Practice on utility commands in DOS.
2. Composing, Correcting, Formatting and Article (Letter/Essay/ Report) on MS Word and taking its print out.
3. Creating, editing, modifying tables in MS ACCESS.
4. Creating labels, report, generation of simple forms in MS ACCESS.
5. Creating simple spread sheet, using in built functions in MS EXCELL.
6. Creating simple presentation on Power Point.
7. Creating mail ID, Checking mail box, sending/replying e-mails.
8. Surfing web sites, using search engines.

SUBJECTS FOR ELECTRICAL ENGG.

2.7 ELECTRICAL MACHINE - I

L	T	P
3	1	4

Rationale

Knowledge of various types of electrical machines including their performance characterstics is necessary to enable a diploma holder in electrical engineering to select, operate, maintain, test and repair/replace electrical machinery used in various industrial and domestic applications.

Knowledge of various parts and constructional details is also necessary when the diploma holder is placed in a manufacturing industry.

Thus to impart knowledge about the common types of electrical machines which a diploma holder deals with, are d.c. machines, transformers, synchronous machines, voltage regulator etc.Therefore these machines should be taught.

Sl.No.	Units	Coverage Time L	T	P
1.	Generalised treatment	20	5	-
2.	D.C. machines	24	8	-
3.	Transformer	24	8	-
4.	A. C. Generator	7	4	-
		75	25	100

1. Generalised Treatment of Electrical Machines:-

   1.1 Definitions of motor and generator.

   1.2 Torque due to alignment of two magnetic fields and concept of torque angle

   1.3 Elementry concept of generator and motor

   1.4 Classification of main types of electrical machines and their generalised treatments in respect of their Working (only d.c. machine to be dealtwith).

   1.5 Common features of rotating electrical machines.

2. D.C. Machines

   2.1 Construction of d.c. machines.
   2.2 E.M.F. equation
   2.3 Electromagnetic torque (torque equation)
   2.4 Principle of generating and motoring action.

2.5 Speed and torque equation
2.6 Armature reaction and commutation in d.c. m/cs.
2.7 Factors controling speed of d.c. motor.
2.8 Speed control methods and starters for d.c. m/cs.
2.9 Characterstics and application of D.C. generators and motors.

3. Transformer

3.1 Classification, construction, principle and working of 1 ph. and 3 ph. transformer.
3.2 E.M.F. equation.
3.3 Phasor diagram on noload and load.
3.4 Transformer connections.
3.5 Losses and efficiency.
3.6 Voltage drops and regulation.
3.7 Connections for parallel operation.
3.8 Cooling
3.9 Testing of transformer as per IS specification (Type test and routine test, etc.)
3.10 Special transformer - current transformer, potential transformer uses of C.T. and P.T., auto transformer, rectifier transformer, dry type transformer, furnace transformer earthing transformer, traction transformer and its use.
3.11 Welding transformer: constructional detail, comparison between power and welding transformer.

4. A. C. Generator (Alternator)

Working principle, construction, Full pitch and short pitch winding, pitch factor or coil span factor, distribution or winding factor, E.M.F. equation, rating of alternators, armature reaction, voltage drops in allternator, vector diagram of loded alternator, voltage regulation and its determination, Efficiency of alternator, conditions for parallel operation, Methods of parallel operation, operation of alternators when connected to infinite bus bar. Voltage regulator like tirril and brown bovery type.

ELECTRICAL MACHINE LAB

1. Measurement of induced emf and magnetising current under open circuit condition in D.C. generators.

2. Determination of the relationship between terminal voltage and load current keeping speed constant for

   (a) Separately excited generator keeping excitation constant

   (b) D.C. shunt generator.

3. To measure the variation in no load speed of a separately excited d.c. motor for the variation in

   (a) Armature circuit resistance

   (b) Field circuit resistance.

4. Measurement of the speed of a d.c. series motor as a function of the load torque.

5. (a) No-load and short circuit test on a single phase transformer.
   (b) Determination of efficiency and regulation of transformer.

6. To determine the insulation resistance of a transformer at no load and at full laod condition.

7. Determination of the magnetisation curve of an alternator (a) at no-load rated speed,(b) at no load half rated speed and (c) at full non-inductive load and rated speed.

8. Determination of the relationship between terminal voltage and load current of an alternator keeping exitation and speed constant.

9. Determination of regulation and efficiency of an alternator from open circuit and short circuit tests.

10. Parallel operation of polyphase alternators and laod sharing.

2.8 POWER PLANT ENGINEERING

L	T	P
3	1	-

Rationale

Present day civilization of mankind is closely interwoven with energy and in future our existence will be more dependent upon energy. As more and more of energy is produced per person, the comforts, conveniences, and pleasure of life increases with it. As such with the increase in the number of generating plant more diploma holders wil be required to run these power plants. Hence we are introducing this with the following objectives:

i. To acquaint the student with different sources of energy and its utilization to obtain mechanical work,

ii. To introduce the principles of steam generation, hydro-power generation and nuclear power generation, diesel power generation and gas turbine generation.

iii. To study the related problems associated with generation.

Sl.No	Units	Coverage Time L	T	P
1.	Thermal stations	12	4	-
2.	Hydroelectric plants	12	4	-
3.	Nuclear power plants	9	3	-
4.	Diesel power plants	6	2	-
5.	Gas turbine plants	9	2	-
6.	Combined working of power plants	9	3	-
7.	Non Conventional Source of Energy	9	4	-
8.	Recent Developments	9	3	
		75	25	-

DETAILED CONTENTS

1. Thermal Stations:

Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment,problem of ash disposal, circulating water schemes and supply of make up, water, choice of pressure of steam generation and steam temperature, selection of appropriate vaccum; economiser, air pre-heater feed water heaters and dust collection. Characterstics of turbo alternators, steam power plant heat balance and efficiency.

2. Hydro-Electric Plants:

Hydrology, stream flow, hydrograph, flow duration curves. Types of hydroelectric plants and their fields of use, capacity calculations for hydropower, Dams, head water control, penstocks, water turbines, specific speeds. turbine governors. Hydroplant auxillaries, plant layout, automatic

and remote control of hydroplants, pumped storage projects, cost of hydro-electric project. Cooling of alternators.

3. Nuclear Power Plants:

Elements of nuclear powr plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.

4. Diesel Power Plants:

Diesel engine performance and operation. Plant layout. Log sheets, applications selections of engine size.

5. Gas Turbine Plants:

Plant layout, methods of improving output and performance. Fuels and fuel systems. Methods of testing. Open and closed cycle plants. Operating characterstics. Applications. Free piston engine plants, limitation and applications.
Non conventional energy sources.

6. Combined Working of Power Plants:

Advantages of combined working of different types of power plants. Need for co-ordination of various types of power plants in power systems, base laod stations and peak load stations.

7. Non Conventional Source of Energy:

Introduction, Concept of Solar Energy, Bio Mass Energy, Wind Energy, Tidal Energy, Geothermal Energy, Microhydel Energy, Biodiesel Energy.

8. Recent Development :

Interconnection of P.S. - Meaning of Interconnection, combined operation of hydro power station with inter connected base load and peak laod, parallel operation of inter connectors.

2.9 TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER:

L T P
3 1 -

Rationale:

The polytechnic passouts have to perform variety of activities in the State Electrictiy Boards, NTPC, NHPC, and NPC in the field of Transmission and Distribution of Electrical Power. The range of these activities vary from simple administrative jobs to public relations, operation and maintenance of equipment and line, fault location, planning and designing of simple distribution schemes, and Executive and Supervisory control in Transmission and Distribution Networks.

It is expected that the different topics in this subject are treated to develop knowledge and skills in the students so that they are able to handle the above jobs efficiently. The topics on transmission and distribution should take into account the use of electricity in rural areas also.

In order to provide practical orientation to the studetns, guide visits to power stations, substations and sufficient use of Audio Visual Aids in these subject areas is highly recommended. The students should be made aware of the recent developments, current practices in the Electricity Boards to keep them abreast with the modern techniques in the Transmission and Distribution of electrical power.

Sl.No.	Units	Coverage time L	T	P
1.	Electrical design of lines	9	3	-
2.	Constructional features of transmission lines	9	3	-
3.	Economic principle of transmission	9	3	-
4.	Mechanical design of lines	9	3	-
5.	Distribution systems	9	3	-
6.	Construction of distribution lines	6	2	-
7.	Power factor improvement	9	3	-
8.	Under ground cables	9	3	-
9.	Carrier communication	6	2	-
		75	25	

DETAILED CONTENTS

1. Electrical Design of Lines :

Layout of different transmission and distribution systems, advantages of high voltage transmission, HV DC convertor transformer concept of short medium and long lines, parameters of lines, performance of short lines (Regulation, efficieny,vector diagrams) corona formation and its effects on performance of lines.Effect of provision of protection and demand side management on reduction of T & D logic.

2. Constructional Features of Transmission Lines:

Constructional features of transmission lines,types of supports, types of conductors, types of insulators, their properties, selection and testing, voltage distribution of string insulators, equalisation of potential. Vibration dampers.

3. Economic Principle of Transmission:
Kelvin's law, limitations of Kelvin's law, Modification in Kelvin's law.

4. Mechanical design of lines :
Sag : Sag measurement, use of sag template Indian Electricity Rules pertaining to clearance, stringing of lines.

5. Distribution System:

Feeders distributors and service mains, radial and ring main distributors, A.C. distributors fed from one end and both ends. Simple problems on size of feeders and distributors.

6. Construction of Distribution Lines:

Construction of distribution lines i.e. erection of pole, fixing of insulators on conductors, testing, operation and maintenance of lines.

7. Power Factor Improvement:

Effect of low power factor, causes of low power factor, necessity for improvement of power factor, methods for improving power factor. Advantages of improved power factor by installing capacitors at consumer end.

8. Underground Cables:

Power cable construction, comparison of over head lines and under ground cables, laying of cables,cable jointing, using of apoxy resin kits. fault location, Murray loop test, testing of cables, specifications.

9. Carrier Communication:

Prinicple of carrier communication over Power Lines, purposes, equipment, difference between radio transmission and carrier communication, block diagrams. Voltage control.

Faults and Production :
Causes and types of fault i.e. L-L, L-G, L-L-G. Awareness and concept of energy conservation.

SUBJECTS FOR ELECTRICAL ENGG. (INDUSTRIAL CONTROL)

2.10 ELECTRICAL MACHINES

L	T	P
3	1	3

Rationale :

Various types of electrical machines are widely used in industrial and domestic applications. A diploma holder in Electrical Engineering is entrusted with the responsibilities of operation, testing, maintenance, repairs, construction details and performance characteristics of electrical machines like DC machines, Synchronous machines. Induction motor, Transformer fractional horse power motor's which a diploma holder deals with should be taught.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Coverage Time L	T	P
1.	Transformer	15	5	-
2.	D. C. Machines	15	5	-
3.	Synchronous Machines	21	7	-
4.	Three Phase Induction Motor	12	4	-
5.	F. H. P. Motor	12	4	-
	Total	75	25	75

DETAILED CONTENTS

1. TRANSFORMER :

1.1 Classification, construction, principle and working of single phase and three phase transformers.

1.2 E. M. F. equation

1.3 Phasor diagram on no load an load

1.4 Losses and efficiency.

1.5 Voltage drops and regulation.

1.6 Transformer connections.

1.7 Parallel operation.

1.8 Cooling

1.9 Type test and routine test.

1.10 Construction and working of single phase and three phase auto transformers.

1.11 Special purpose transformers : Rectifier transformer, earthing transformer, traction transformer and their use.

2. D. C. MACHINES :

2.1 Construction of d. c. machines.

2.2 E. M. F. equation

2.3 Electromagnetic torque (torque equation)

2.4 Principle of generating and motoring action

2.5 Speed and torque equation.

2.6 Armature reaction and commutation in d.c. m/cs

2.7 circuit representation of d. c. machines.

2.8 Starters for d. c. machines.

2.9 Characterstics and appliation of D. C. generators and motors

2.10 Concept of spead control.

3. SYNCHRONOUS MACHINES :

3.1 Construction and working principle of synchronous machines (Alternator and Synchronous motor)

3.2 Winding configurations, full pitch and short pitch winding.

3.3 E. M. F. equation. Effect of coil span factor and distribution factor.

3.4 Armature reaction.

3.5 Phasor diagram of alternators and synchronous motor.

3.6 Voltage regulation and its determination in alternator.

3.7 Losses and efficiency of synchronous machines.

3.8 Effect of load and excitation on the performance of synchronous motor, V-curves.

3.9 Torque and mechanical power developed in synchronous motor, hunting and its elimination.

3.10 Starting methods and application of synchronous motor, synchronous condenser.

3.11 Parallel operation of two alternators.

3.12 Brown boveri and Tirril voltage regulators.

4. THREE PHASE INDUCTION MOTOR :

4.1 Construction and working principle of three phase induction motors (Squirrel cage and Slip ring motors).

4.2 Concept of rotating magnetic field for the running of three phase induction motor and its reversing.

4.3 Phaser diagram and equivalent circuit.

4.4 E. M. F. and current in rotor circuit.

4.5 Torque equation, torque slip characteristics.

4.6 Losses and efficiency.

4.7 Methods of starting on line, Auto transformer, Star delta starters, Starter for slip ring induction motor.

4.8 Concept of speed control.

4.9 Testing of induction motor.

4.10 Application

4.11 Comparison of three phase induction motor with three phase synchronous motor.

5. F. H. P. MOTOR :

5.1 Classification of F. H. P. Motor

5.2 Double revlving field theory and principle of operation of single phase induction motor.

5.3 Construction, Working and application of -

(a) Capacitor Motor (All Types)

(b) Shaded Pole Motor

(c) Single Phase Series and Universial Motor

(d) Repulsion Motor

(e) D. C. and Two phase A. C. servo motors.

(f) Stepper Motor

LIST OF PRACTICALS

1. Measurement of induced emf and magnetising current under open circuit condition in D. C. generators.

2. Determination of the relationship between terminal voltage and load cirrent keeping speed constatnt for D. C. shunt generator.

3. To measure the variation in no load speed of a separately excited d. c. motor for the variation in

   (a) Armature circuit resistance

   (b) Field circuit resistance

4. Measurement of the speed of a d. c. series motor as a function of the load torque.

5. (a) No-load and short circuit test on a single phase transformer.

   (b) Determination of efficiency and regulation of tranformer.

6. To determine the insulation resistance of a transformer at no load and at full load condition.

7. Determination of the megnetisation curve of an alternator (a) at no-load rated speed, (b) at no-load half rated speed and (c) at full non inductive load and rated speed.

8. Determination of the relationship between terminal voltage and load current of an alternator keeping exitation and speed constant.

9. Determination fo regulation and efficiency of an alternatr frm open circuit and short circuit tests.

10. Parallel operation of polyphase alternators and load sharing.

11. To start a Three Phase Induction motor and to determine its slip at various loads.

12. To determine "V" curves of synchronous motor.

13. To connect and start an induction motor by using Star Delta, Autotransformer starter and to change its direction of rotation.

14. To perform onpen circuit and blocked rotor test on a Three Phase incuction motor and determine its efficiency.

2.11 GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTICAL POWER

L	T	P
3	1	-

Rationale :

The passout diploma holders in Electrical Engineering have to perform variety of activities whien employed iun the State Electricity Board, N.T.P.C., N.H.P.C, N.P.C., etc. in the field of generation, transmission and distribution of the electrical power. The range of these activities varries from plant operation to maintenance and repairs of equipment, erection and maintenance of transmission and distribution schemes. Therefore, it is desirable that the adequate knowledge about various power plants transmission and distribution schemes be provied to these diploma holders. The students should be made aware of the recant developments, Current practces followed in the Electricity Boards to keep them abreast with the modern techniques in the field of generation, transmission and distribution of electrical power. The contents of this course have been selected considering all these factors in account.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Coverage Time L	T	P
1.	Power Plants	27	9	-
2.	Non Conventional Power Generation	9	3	-
3.	Power Plant Economics	9	3	-
4.	Constructional Features of Transmission & Distribution Line	9	3	-
5.	Transmission System	9	3	-
6.	Distribution System	6	2	-
7.	Under Ground Cables	6	2	-
	Total	75	25	-

DETAILED CONTENTS

1. POWER PLANTS :

(A) Thermal Power Plant :

Plant layout and working of various elements, fuel handling combustion, combustion equipment, Steam generation and its temperature and pressure, environmental pollution due to dust and ash, methods of

dust collection, cooling of turbo-alternators.

(B) Hydro-Electric Power Plant :

Plant layout and working of various elements, Hydrology and hydrograph, flow duration curves, Types of hydrograph plants and their use, Water turbines, Automatic and remote control of power plants, ---- Head water control and Penstocks, Pumped storage plant.

(C) Nuclear Power Plant :

Plant layout and working of various elements. Fuels, Classification of nuclear power stations. Types of nuclear reactor, Coolants.

(D) Other Plants :

Plant layout and working of various elements of gas turbine plant, Open and closed cycle plants, Fuel and Fuel systems.

2. UNCONVENTIONAL POWER GENERATION :

Types of non-conventional energy resources, Solar cell and Solar power generation, Wind power generation, Role of unconventional power generation on rural socio-economic grawth.

3. POWER PLANT ECONOMICS :

Load estimation, Load curves, Load and diversity factors, Demand factor, Plant capacity and utilization factors. Cost of generation and influence of load and diversity factors, Tariff and various methods of calculation, Bill preparation. Causes and effect of low power factor methods for improving power factor.

4. CONSTRUCTION FEATURES OF TRANSMISSION AND DISTRIBUTION LINES:

Constructional features of transmission and distribution lines. Types of supports, Types of conductors, Types of insulators. Erection of transmission towers and distribution poles. Fixing of insulators aon conductors, testing, operation and maintenance of distribution lines. Testing of insulators, Voltage distribution of strinig insulators, Vibration dampers. Basic idea of Sag calculation.

5. TRANSMISSION SYSTEM :

Short, medium and long transmission lines. Parameters of lines. Performance of short lines (Regulation, Efficiency, Vactor diagram). Corona formation and its effects on performance of lines.

Advantage of EHV transmission. Concept of HVDC transmission

and its salient feature. Kelvin's law its limitations and utility.

6. DISTRIBUTION SYSTEM :

Feeders, distributors and service mains, radial and ring main distributors, A. C. distributors fed from one end and both ends (Simple problems on feeders and distributors).

7. UNDERGROUND CABLES :

H. T. and L. T. power cables construction, Cable joining, Laying of cables, Fault location, Murray loop test, Testing of cables, Comparison of underground cable with over head line.

2.12 POWER ELECTRONICS

L	T	P
2	1	2

Rationale :

Power electronics deals with high power solid state switching devices. It combines power, electronics and control. It is the application of the solid state electronics for the control and conversion of electric power. Power electronics has already found an important place in industries and are now used in a great variety of higher power applications including heating and welding controls, illumination controls, electric deive controls, power supplies, vehicle propulsion system, higher voltage direct current transmission and many other areas. An electrical enginering diploma holder has to deal with various power electronics equipment and controllers in the industry. Therefore, he should have adequate knowledge of operation and applications of high power switching devices as well as of power electronics and equipment.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Coverage Time L	T	P
1.	Introduction	6	3	-
2.	Power Semiconductor Diodes	6	3	-
3.	Thyristors	3	1	-
4.	Power Transistors	6	3	-
5.	Controlled Rectifiers	6	3	-
6.	A. C. Voltage Controllers	6	3	-
7.	Choppers	6	3	-
8.	Inverter	6	3	-
9.	Power Supplies	5	3	-
	Total	50	25	50

DETAILED CONTENTS

1. INTRODUCTION :

   (I) Role of power electronics in the field of electric power control.

   (II) Salient features of power semiconductor devices and relative comparison from application point of view.

   (III) Characteristics and symbols of power semiconductor devices.

   (IV) Types of power electronic circuits.

2. POWER SEMI CONDUCTOR DIODES :

(I) Characteristics and applications of general purpose diode, fast recovery diode and schottky diode.

(II) Series and Parallel operation of power diodes.

(III) Performance parameters.

3. THYRISTORS :

(I) Construction, characteristics and application of SCR, Gate, Trun off thyristor (GTO thyristor), Light activated SCR and reverse concucting SCR, Performance parameters.

(II) Methods of triggering a SCR, Gate characteristics. General layout of gate triggering circuits, R-C firing circuit, characteristics of UJT and its application in the triggering of SCR, Triggering of GTO thyristor.

(III) Commutation fo SCR, emtods of commutaing a SCR, convrter grade and Inverter grade SCRs.

(IV) Series and Parallel operation of SCR.

(V) Protection of SCR and GTO thyristor.

(VI) Construction, Characteristics and applications of Diac and Triac.

4. POWER TRANSISTORS :

(I) Characteristics and application of Bipolar Junction, Transistor, Power MOSFET, Performance Parameter.

(II) Base drive requirements, Typical base drive circuits.

(III) Service and parallel operation of power transistor.

(IV) Protection of power transistor.

5. CONTROLLED RECTIFIERS :

(I) Phase controlled rectifier operation on resistive and resistive inductive loads. Use of free wheeling diode.

(II) Single phase and Three phase controlled and fully controlled bridge rectifiers, Dual converters, Effect of load and source inductance. Performance comparision. Capacitor aided commutation.

(III) Single phase and Three phase line commutated bridge invertors.

(IV) Simple numerical problems on controlled rectifiers.

6. A. C. VOLTAGE CONTROLLERS :

(I) Principle of integral cycle control and phase control.

(II) Single phase and Three phase A. C. voltage controllers. Various configurations.

(III) Single Phase transformer Tap Changer.

(IV) Single phase and Three phase Cyclo-Converter.

7. CHOPPERS :

(I) Principle of operation and control techniques of chopper, corrent and voltage waveforms for resistive inductive static and motor loads, effects of chopper frequency and load inductance.

(II) Voltage commutated and current commulated thyristor chopper circuits. POower transistor chopper circuits, Use of input and output D. C. filters.

(III) Step up chopper and its applications.

8. INVERTERS :

(I) Single phase series and paralle inverters. Output voltage and current waveforms.

(II) Principle of operation of bridge inverter concept of voltage source. Current source and Pulse width modulated bridge inverter. Performance parameters.

(III) Single phase and Three phase voltage source (auxillary and complementary commutated only) and current source bridge inverters, methods of voltage control, various techniques of pulse width modulation, comparison of voltage source and current soruce inverters application.

(IV) High frequency inverters and their application.

9. POWER SUPPLIES :

(I) D. C. and A. C. power supplies, Switched mode power supplies, Resonant power supply and Bi-directional power supply.

(II) Switching mode requlators, Principle of switching mode regulator; Bulk, Boost, Bulk-Boost regulators.

LIST OF PRACTICALS

1. V-I characteristics of SCR.
2. Study of R-C firing circuit of SCR.
3. Study of UJT firing circuit of SCR.
4. Study of Power Transistor as a switch.
5. Study of SCR as a switch.
6. Power control using Diac and Triac.
7. Fabrication and testing of Half Cintrolled Bridge Rectifier circuit.
8. Fabrication and testing of SCR Chopper Circuit.
9. Fabrication and Testing of Single Phase Series inverter circuit.

COMMON SUBJECTS

3.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
2	2/2	-

Rationale:

The knowledge of this subject is required for all engineering technicians, but it becomes more important for those technicians who wish to choose industry as their career. This course is designed to develope understanding of various functions of management, role of workers, and engineers, industrial safety, trade unions, wages and incentives, marketing, entrepreneurship, inventory control and industrial legislation.

Sl.No.	Units	Coverage Time L	T	P
1.	Principles of Management	10	4	-
2.	Human Resource Management	3	2	-
3.	Human and Industrial Relations	4	3	-
4.	Personnel Management	6	3	-
5.	Financial Management	6	3	-
6.	Material Management	4	3	-
7.	Labour, Industrial and Tax Laws	4	2	-
8.	Entrepreneurship Development	8	4	-
9.	Intellectual Property Rights	5	1	-
		50	25	-

DETAILED CONTENTS

1. PRINCIPLES OF MANAGEMENT :

Definition of management, Administration organisation, Functions management, Planning, Organizing, Co-ordination and control, Structure and function of industrial organisations, Leadership- Need for ledership, Factors to be considered for accomplishing effective leadership, Communication -Importance, Processes, Barriers to communication, Making communication, Effective, formal and informal communication, Motivation - Factors determining motivation, Positive and negative motivation, Methods for imporving motivation, Incentives, Pay promotion and rewards, Controlling - Just in time, Total quality management, Quality circle, Zero defect concept. Concept of Stress Management

2. HUMAN RESOURCE DEVELOPMENT :

Introduction, Staff development and career development, Training strategies and methods.

3. HUMAN AND INDUSTRIAL RELATIONS :
Human relations and performance in organisation, Understand

self and others for effective behaviour, Industrial relatios and disputes, Charcteristics of group behaviour and Trade unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

Responsibilities of human resource management - Policies and functions, Selection - Mode of selection - Procedure - training of workers, Job evalution and Merit rating - Objectives and importance wage and salary administration - Classification of wage, Payment schemes, Components of wage, Wage fixation.

5. FINANCIAL MANAGEMENT :

Fixed and working capital - resource of capital, Shares, types preference and equity shares, Debentureptypes, Public deposits, Factory costing, Direct cost, Indirect cost, Factory over head, Fixation of selling price of product, Depreciation- Causes, Methods.

6. MATERIAL MANAGEMENT :

Objective of a good stock control system - ABC analysis of inventory, Procurement and conumption cycle, Reorder level, Lead time, Economic order quantity, Pruchasing procedure, Stock keeping, Bin card.

7. LABOUR, INDUSTRIAL AND TAX LAWS :

Importance and necessity of industrial legistation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Imcome Tax.

8. ENTREPRENEURSHIP DEVELOPMENT :

Concept of entrepreneurship, need of entrepreneurship in context of prevailing employment conditions of the country. Sucessful entrepreneurship and training for entrepreneurship development. Idea of project report preparation.

9. INTELLECTUAL PROPERTY RIGHTS :

Introduction to IPR (Patents, Copy Right, Trade Mark), Protection of undisclosed information, Concept and history of patents, Indian and International Patents Acts and Rules, Patentable and Nonpatentable invention including product versus Process.

NOTE : Entrepreneurship Awareness camp to be organised at a stretch for Two or Three days. Lectures will be delivered on Entrepreneurship by industries experts at institute level.

3.2 INSTALATION,MAINTENANCE AND REPAIR OF ELECTRICAL MACHINES

RATIONALE:

L	T	P
2	-	4

Many of the electrical technicians employed in State Electricity Boards or other electrical industires are engaged in installation, maintenance and repair of a variety of electrical equipment. Such areas may include generation transmission and distribution systems, different types of electrical drives used with a variety of mechanical gadgets. Normally manufacturers of heavy electrical equipment provide service manuals instruction sheets for installation, maintenance and fault location. Indian electricity rules and Indian Standard Specification also provides enough guidelines. This syllabus has been designed to provide certain guidelines and broad principles regarding the above activities. appropriate field trips will reinforce the learning.

Sl.No.	Units	Coverage Time L	T	P
1.	Scope of organisation	6	-	-
2.	Installation and commissioning	8	-	-
3.	Preventive maintenance	8	-	-
4.	Trouble shooting	8	-	-
5.	Earthing	6	-	-
6.	Insulation testing	6	-	-
7.	Electrical accidents & safety	8	-	-
		50	-	100

1. Scope and Organisation of Electrical Maintenance Department:

   Requirement of electrical maintenance department, organisation of work of electrical m/c department, office work and record keeping of electrical maintenance department, history & plant maintenance log book & job cards.

2. Installation and commissioning:

   General guidelines for loading and unloading of heavy electrical machines. Brief description of the accessaries used for loading and unloading of heavy electrical equipement. List of precautions to be taken while executing such jobs. Handling & transport of electrical machine, equipment & line accessaries to site.Installation of electrical equipement like induction motors, transformers, switch gears, transmission and distribution lines etc. Allingment of the equipment, testing and commissioning of different types of electrical equipment, transmission and

distribution lines etc. Precautions while installation is in progress. Testing of installation before declaring it to be fit for energising.

3. Preventive Maintenance of Electrical Equipment and other installations:

Meaning of preventive maintenance, advantages of programmed preventive maintenance, preparation of preventive maintenance schedule for transformers,transmission lines, induction motors, circuit breakers, underground cables, storage batteries etc.

4. Trouble Shooting:

Causes for failure of electrical equipments, classifcation of faults under (i) electrical, (ii) magnetic (iii) mechanical, tool and instruments used for trouble shooting and repair. Use of trouble shooting charts. Diagnosis of faults in (i) d.c.machines (ii) Synchronous machines (iii) trans- formers, (iv) induction motors, (v) Circuit breakers, (vi) Overhead & underground distribution lines(vii) Storage batteries (viii) other appliances.

5. Earthing Arrangements.

Reasons for earthing of electrical equipment, earthing systems, permissible earth resistance for different types of installations, methods of improving the earth resistance, measurement of earth resistance. System earthing and equipment earthing.

6. Insulation Testing:

Classification of insulation as per ISS 1271/1958. Insulation resistance measurement, effect of temperature on resistance, reasons for determination of insulation resistance, methods of improving insulation resistance, vaccum impregnation, transformer oil testing and interpretation of the test results.

7. Electrical Accidents and Safety:

Classification of electrical accidents, statuory regulations (IS 5216-1969), treatment for electric shock, artificial respiration, types and use of different types of fire extinguishers. Dangerous currents and voltages, effect of current on human body. Step and touch potentials, R.C.Ds. and earth leakage circuit breakers. General ideas about protection against lightning, explosive safety against static and current electricity, important Indian electricity rules.

E. M. R. Lab:

1. Setting handling of tools and accessaries for installing heavy equipment.

2. Commissioning of electrical equipment.

3. Measurment of earth resitance.

4. Testing of transformer oil.

5. Fault finding and repairing of different types of electrical wiring.

6. Disassembling and assembling of electrical machines e.g. electric iron,washing machines.geyser,submersible pumps,coolers etc.

7. Trouble shooting and repairing of different types of domestic and industrial electrical equipment.

8. Winding of small ac motor/transformers/chokes.

9. Cable jointing using epoxy resin kits.

10. Repair and maintenance of circuit breakers up to 11 kv.

11. Trouble shooting and repair of direct on line and star delta starter.

3.3 SWITCH GEAR AND PROTECTION

L	T	P
2	1	-

Rationale

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma passout have become more complex than what they used to be earlier. He is required to work with modern electrical equipment and maintain relialbility of supply.

The course is designed to develope the understanding of the principles and working of protective switchgear so that one can handle, install, maintain them and also take decisions at his level in different situations.

This subject teaching requires reinforcement from visits to substation, power stations and well designed laboratory experiences. A practical orientation to the teaching of this subject is suggested.

Sl.No.	Units	Coverage L	T	Time P
1.	Faults	8	4	-
2.	Switch gear	12	6	-
3.	Protective schemes	12	6	-
4.	Protection against over voltages	4	2	-
5.	Different types of substations	14	7	-
		50	25	-

DETAILED CONTENTS

1. Faults:

Types of faults, three pahse symetrical faults, effects of faults on system reliability and stability abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams.

2. Switch Gear:

2.1 Purpose of protective gear, characterstics of a protection system.

2.2 Classification of fuses H.V. Fuses, application and working, grading and co-ordination L.V. fuses, selection of fuses, characterstics.

2.3 Isolators and switches, out door isolators, functions, air break switches braking capacity of switches.

2.4 Circuit breakers :- requirements of circuit breakers definition of terms associated with circuit-breakers, reasons for arc formation, principles of arc extinction, types of circuit-breakers, comparison

with oil circuit breaker classification, rating of circuit breakers, working of different types of air and oil circuit breaker, specification of circuit breakers, maintenacne schedule. SF-6 and Vaccum circuit breakers.

2.5 Relays : Requirement of relays, operation principles induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction of distance relay.

3. Protective Schemes:

3.1 Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults their reasons, effect and protections used.

3.2 Protection of power transformer : types of faults, its effects, types of protective schemes over current earth fault, differntial protection, Buckholtz devices, winding temp. protection.

3.3 Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection.

3.4 Protection of feeders : radial, parallel and ring feeders protection, directional time and current graded schemes differential protection.

4. Protection Against Over Voltages:

4.1 Causes of over voltages, travelling waves earth wire, protective zone, lighteing arrestors, space-gap and electrolytic arrestors, surge absorber,location and rating of lightening arrestors.Thyrite lightening arrestor.

5. Different Type of Sub-Stations:-

5.1 Layout, single line diagram busbar arrangment, equipments their fuctions, accessaries, study of protective schemes, etc. batteries and their maintenance, operation of small sub-station.

5.2 Reactors: types of reactors, busbar reactor, tuning reactor, arc-suppression reactor, connection of reactors in power stations. uses of reactors.

5.3 Nutral grounding :- types of grounding solid grounding, reactance grounding, arc suppression coil grounding, choice of method of neutral earthing. grounding of sub-station, grounding of line structure and sub station equipment.

5.4 Concept of G.I.S. (Gas Insulated Substation).

3.4 ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

L	T	P
2	-	-

RATIONALE:

A diplima student must have the knowledge of different types of pollution caused due to industrialisation and construction activities, so as he may help in balancing of eco-system and control pollution by providing controlling measures. They should be also aware of the environmental laws for effectively controlling the pollution of environment. The topics are to be taught in light of legislation Para-3.

TOPIC WISE DISTRIBUTION OF PERIODS:

SL. NO.	TOPIC	L	T	P
1.	Introduction	6		
2.	Pollution	3		
2.1	Water Pollution	8		
2.2	Air Pollution	8		
2.3	Noise Pollution	3		
2.4	Radio Active Pollution	4		
2.5	Solid Waste Management	5		
3.	Legislations	3		
4.	Environmental Impact Assessment	4		
5.	Disaster Management	6		
	TOTAL	50	-	-

DETAILED CONTENTS

1. INTRODUCTION :

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigration, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.

- Lowering of water level , Urbanization.

- Biodegradation and Biodegradibility, composting, bio remediation, Microbes .Use of biopesticidies and biofungicides.

- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc.

2. POLLUTION :

Sources of pollution, natural and man made, their effects on

living environments and related legislation.

2.1 WATER POLLUTION :

- Factors contributing water pollution and their effect.

- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.

- Physical, Chemical and Biological Characteristics of waste water.

- Indian Standards for qulity of drinking water.

- Indian Standards for quality of treated waste water.

- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION :

Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, GO, CO2, NH3, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.

A. Settling chambers
B. Cyclones
C. Scrubbers (Dry and Wet)
D. Multi Clones
E. Electro Static Precipitations
F. Bog Fillers.

- Ambient air qulaity measurement and their standards.

- Process and domestic emission control

- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION :

Sources of noise pollution, its effect and control.

2.4 RADISACTIVE POLLUTION :

Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT :

Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. LEGISLATION :

Preliminary knowledge of the following Acts and rules made thereunder-

- The Water (Prevention and Control of Pollution) Act - 1974.

- The Air (Prevention and Control of Pollution) Act - 1981.

- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.

  # The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000

  # The Hazardous Wastes (Management and Handling) Amendment Rules, 2003.

  # Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.

  # The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.

  # Municipal Solid Wastes (Management and Handling) Rules, 2000.

  # The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) :

- Basic concepts, objective and methodology of EIA.

- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benifit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

3.5 PROJECT

L	T	P
-	-	4

Rationale

A survey for job anlysis of technician reveal that several times he has to solve many challenging problems. For solving such problems he may have to use both the theoretical knowlege and manipulative skills he has acquired during his studies. Project by definition means that for a given problem to identify the possible alternative solutions, to select one, to implement and evaluate. It should help in developing certain interpersonal skills, decision making skills, report writing etc. The evaluation of the project should not be based only on end product. The process is equally important and due recognition should be given for its evalution. There could be different approaches to design a curriculum for 'project.' One possible approach is suggested here.

Introduction:

The project work is grouped under following three heads. A number of projects have been mentioned under each head (i.e. group). A student should take atleast two projects, both of which should not be from the same group.

Sr. No.	Units	Coverage Time L	T	P	
1.	Developmental projects	-	-	100	(any
2.	Fabrication projects	-	-	100	two)
3.	Estimating and costing projects	-	-	100	
	Total			200	

DETAILED CONTENTS

1. Developmental Projects:

Students are expected to design the item, identify the material and the manufacturing process, prepare one prototype and test it for its satisfactory operation. The report of such projects should be written as per requirement laid down by state. Department of industries may consider for sanctioning of loan and other subsidies for entrepreneures. It should include feasibility report, costing, sales strategy, monetary requirements, design, manufacturing process, materials and testing.

2. Fabrication Projects:

Under these projects, students will fabricate the item or set up facilites for carrying out specific job. The report will include basic principles and concepts used in

describing the working of the item/activity, specification of materials being used, detailed description of manufacturing process and specifications of machine tools used, testing procedure and test report, total cost of the item etc.

3. Estimating And Costing Projects:

Under such projects students will prepare an estimate of providing Electrical installations in the given building using standard norms and practices. The report should include: assumptions; designing of electrical layout, layout plan, detailed circuit diagram, list of material required and their specification, cost estimation, testing procedure etc. The project report should be prepared on the pattern it is prepared by state electricity board/PWD for similar jobs.

NOTE:

It is pointed out that the projects mentioned under each group are some suggestions only. Teachers may choose other similar projects under each group and get them approved by a committee headed by the Head of Electrical Engineering Department.

1. DEVELOPMENT PROJECTS:

1.1 Small transformers (upto 250 VA)
1.2 Tube light choke (40 W)
1.3 Automatic star-delta starter
1.4 Fan regulators (choke type)
1.5 Fan regulator (resistance type)
1.6 Desert cooler (using standard fan and pump)
1.7 Storage water heaters (geysers) 25 Lt.
1.8 Air blower type room heater (2 Kw)
1.9 Electroplating unit (nickel, chromium)
1.10 Repair and maintenance shop for domestic gadgets.
1.11 Voltage stabilizers for refrigerators (.5 Kw)
1.12 Emergency light
1.13 Thyristor control of electric motor.

2. FABRICATION PROJECTS:

2.1 Phase sequence indicator.
2.2 Inductive loading choke, 5 kw, 230 V.
2.3 Automatic curtain operator for a stage
2.4 Automatic water level controller for an overhead Tank
2.5 Rewinding of variac
2.6 Rewinding of FHP motor
2.7 Rewinding of ceiling/exhaust fan.
2.8 Rewinding of refrigerator motor (hermetically sealed)
2.9 Low cast intercom for home
2.10 Regulated power supply
2.11 Solid state fan regulator
2.12 Automatic battery charger
2.13 Burglar alarm
2.14 Hearing aid

2.15 Automatic street light controller (On/OFF only)
2.16 Inverter circuit (500 W)
2.17 Digital clock
2.18 2-band radio receiver (transistorised)
2.19 Stereo amplifier
2.20 Electronic door bell (chordless)
2.21 Light dimmer
2.22 Automatic control of water pump using timer
2.23 Object counter
2.24 Musical door bell with IN-OUT indication
2.25 Battery eliminator
2.26 Erection of overhead distribution over a small distance.

3. ESTIMATING AND COSTING PROJECTS

3.1 Electrical installation in a domestic building including service mains, and earthing.
3.2 Electrical installation in a small workshop including power wiring.
3.3 To provide distribution system through under ground cable in a residential colony.
3.4 5KVA, 3 phase, 11 KV/.415 V pole mounted substation for a farm house.
3.5 Electrical installation in a public building such as school, hospital, community centre, cinema, library, auditorium, club, dispensary, polytechnic etc.
3.6 Electrical installations in a high building.
3.7 Electrical installations in a small govt. colony comprising of different category of houses.
3.8 33 KV/.415 V, 3 ph, 1000 KVA, indoor substation for a bulk consumer.

SUBJECTS FOR ELECTRICAL ENGINEERING

3.6 INDUSTRIAL ELECTRONICS & CONTROL

L	T	P
2	1	2

Rationale

An electrical engineering technician has to bear the variety of responsibilities in industries. He has to deal with manually operated old machines and automatically controlled modern machines and equipments. To deal successfully with vide spectrum of requirements in the industry the passout diploma holder in electrical engineering should be equiped with the knowledge of control system components, thyristor control of electrical machines and other applications of thyristor such as in the control of heating, welding, illumination and static switches etc.

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	4	2	-
2.	High power switching devices	8	4	-
3.	Thyristor and their operation	8	4	-
4.	Thyristor application	8	4	-
5.	Thyristor control of electric machines	8	4	-
6.	Industrial control	8	4	-
7.	Servo mechanism	6	3	-
		50	25	50

1. Introduction:-

(i) Control system classification and method of control.

(ii) Concept of open loop and closed loop control.

(iii) Introduction to automatic control.

(iv) Role of power electronics in the field of control Engg.

2. High power switching devices

(a) Power diode characterstics application of general purpose diode, fast recovery diode. and Schott key diode.

(b) Control switching devices,construction characterstics and aplication of S.C.R., power transistor.

3. Thyristor and their Operation:-

(i) Thyristor and its types.

(ii) SCR, Diac, Triac, their construction, characterstics and applications.

(iii) UJT and its characterstics, LDR, LED and photo electric relay.

(iv) Methods of switching ON and switching OFF SCR.

(v) Phase control using SCR, Diac and Triac and concept of firing angle and its control.

4. Thyristor Application:-

(i) Basic circuit and working of single phase, three phase, half wave, full wave and bridge power convertors (rectifiers) using SCR.

(ii) Basic circuit and working of single phase and three phase bridge invertors using SCR.

(iii) Basic circuit and working of D.C. and A.C. Choppers.

(iv) Basic circuit and working of cycloconvertor.

5. Thyristor Control of Electric Machines :-

Speed control of:

(i) Induction motor.

(ii) D.C.series motor/ shunt motor

(iii) Single phase motor using thyristor

6. Industrial Control:-

(i) Heating control using SCR.

(ii) Welding control using SCR.

(iii) Temperature,illumination and level control.

(iv) Use of SCR and Triac as static switch.

(v) Study of PLC.

7. Servo Machanism:-

Introduction to servomechanism, block diagram open loop & closed loop system, DC & AC servo mechanism, servomotors, application, synchros & application.

INDUSTRIAL ELECTRONICS & CONTROL LAB.

1. Fabrication and testing of electronic fan speed regulator.
2. Power control using Diacs and Triacs.
3. Characterstics of SCR.
4. Speed control of DC shunt motor.
5. Charasteristics of U.J.T. firing circuit of S.C.R.
6. Study of light operated relay using LDR or photo diode.
7. Experiment on Time Delay- Relay using SCR & UJT.
8. Study of servo motor and synchros.
9. Thyristersed speed control of 3 phase induction motor.
10. Fabrication and Testing of inverter circuit.

3.7 ELECT. DESIGN DRAWING & ESTIMATING II

L	T	D
2	1	8

Rationale:

The importance of electrical engineering design, drawing and Estimating for electrical technician has already been explained in the rationale of the subject Electrical Engineering Design, Drawing & Estimating I. The aims of teaching Electrical Engineering Design, Drawing & Estimating II is to develop the following abilities.

i. To read and interpret electrical engineering drawings

ii. To communicate and corelate through sketches and drawings, the actual machine and to impart instructions to the workman.

iii. To prepare working drawing of alternator panel, transmision and distribution system etc.

iv. To design electrical gagets and utility items for fabrication purposes.

v. To prepare estimates of electrical repairs, transmission and distribution systems.

Sl.No	Units	Coverage Time L	T	D
1.	Principle of estimating and costing	6	3	-
2.	Earthing	4	2	-
3.	Estimation of internal wiring circuits	8	4	-
4.	Estimation of power wiring	8	4	-
5.	Estimation of overhead and underground line	8	4	-
6.	Estimation of service connections	8	4	-
7.	Estimation of small substations	8	4	-
		50	25	200

DETAILED CONTENTS

1. Principles of Estimating and Csosting:

Purpose of estimating and costing, essentials of estimating and costing-market survey, price list and net prices, preparation of list of materials, calculation of material and labour cost, contingencies, overhead charges, profit and total cost, quotations-comparative statement and orders, idea about tender forms. Use of E.S.R (state PWD and CPWD)

2. Earthing:

Need for earthing of electrical installations, advantages and disadvantages, effect of improper earthing, I.S. specifications regarding earthing of electrical installations, points to be earthed as per I.E. rules. Methods of earthing-plate and pipe earthing. Determination of size of earth wires and earth plates for different capacities of electrical installations, specification of earthing materials and their cost, Earthing of power plant and grid substation.

3. Estimation of Internal Wiring Installation:

Estimation of wiring installation for commercial and industrial buildings such as multi-storied hotels, hospitals, schools, colleges, cinema, community centers, public library, high rise residential buildings etc. including design of layout, load estimation, Demand factor and diversity factor, power distribution scheme, list of material with specifications, estimation of cost preparing relevent electrical schedule of rate (CPWD or PWD) using latest practices, materials and accessories.

4. Estimation of Power Wiring

I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductors distribution board, main switches and starters for power circuits. Cost of equipments and accessories and schedule of materials. Estimation and cost of material and work for motors upto 20 H.P., pumpsets and small workshops.

5. Estimation of Overhead and Underground Distribution Lines :

Main components of overhead lines-line supports, cross-arm, clamps, conductors and staysets, lightening arrestors, danger plates, anticlimbing devices, bird guards, jumpers etc., concreting of poles, earthing of transmission line, formation of lines, specification of materials for O.H. lines, I.S. specification and I.E. rules. Cost of material and work for overhead and underground lines upto 11 KV only.

6. Estimation of Service Connections:

Service connection, types of service connections-overhead and underground for single story and double story buildings, estimate of materials required for giving service connection to domestic consumers, commercial consumers and industrial consumers at L.T. and H.T. costing of material and work in above cases.

7. Estimation of Small Sub-Station

Main equipments and auxiliaries installed on the sub

station. Estimation of materials required for a small distribution substation (indoor and outdoor type-platform and pole mounted). Costing of material and work of above substations.

DRAWING WORK :-

1.	Earthing	1 sheet
2.	Commercial and industrial buildings	2 sheets
3.	Power wiring layout and circuits	2 sheets
4.	Stays, line crossings, line earthing, end poles and terminal poles, juntion poles/ towers and transposition pole/towers.	2 sheets
5.	Service connection domestic,industrial and agriculture.	2 sheets
6.	Substation layout and busbar arrangements	2 sheets
7.	Machine drawings-induction and synchronous machines.	2 sheets
8.	Winding of induction machine, 3 ph; 1 ph.	2 sheets
9.	Reading and interpreting practical drawing of wiring installation and control circuits.	
10.	Winding of synchronous machine 3 ph. (alternator and synchronous motor)	2 sheet

3.8 UTILISATION OF ELECTRICAL ENERGY

L	T	P
2	1	-

Rationale

This subject assumes importance in view of the fact that a technician has to work in a wide spectrum of activities. He has to make collections for alternative schemes from technical and economical considerations; i.e. to plan and design using basic principles and handbooks, to select equipments, processes and components in different situations.

Keeping the above objectives in view, besides giving him basic knowledge in the topics concerned, attempts have been made to ensure that the knowledge acquired is applied in various fields as per his job requirements.

To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarise the students with the new developments in different areas.

Sl.No.	Units	Coverage Time L	T	P
1.	Illumination	7	3	-
2.	Electric heating	7	3	-
3.	Electric Cooling	7	3	-
4.	Electric welding	7	4	-
5.	Electrochemical processes	6	3	-
6.	Electric Traction	6	4	-
7.	Economic consideration	6	4	-
8.	Energy Conservation	4	1	-
		50	25	-

DETAILED CONTENTS

1. Illumination:

(i) Nature of light, curve of relative sensitivity of human eye and wave length.

(ii) Definitions : flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor coefficient of utilisation, space to height ratio,reflection factor, laws of illumination.

(iii) Calculation of number of light points for interior illumination; calculation of illumination at different points; considerations, involved in simple design problems and illumination schemes; levels of illumination. Methods to increase illumination efficiency

(iv) Different sources of light: Difference in incandescent and discharge lamps - their

construction & characterstics, fittings required for filament lamp, mercury lamp, fluorescent lamp sodium lamp, neon lamp.

(v) Main requirements of proper lighting; illumination level, absence of flare, contrast and shadow.

2. Electric Heating ;

(i) Introduction.

(ii) Advantages of electrical heating.

(iii) Heating methods:

(a) Resistance heating (direct resistance heating, indirect resistacne heating, electric ovens, their temperature range) salt bath heaters properties of heating elements, domestic water heaters and other heating appliances.

(b) Induction heating, principle, core type and coreless induction furnace.

(c) Electric arc heating, direct and indirect arc heating, arc furnace.

(d) Dielectric heating. Applications in various industrial fields, microwave ovens.

(v) Simple design problems of resistance heating element.

3. Electric Cooling

(i) Concept of refrigeration and airconditioning.

(ii) Brief description of vapour compression refrigeration cycle.

(iii) Description of electrical circuit used in

(a) Refrigerator,

(b) Airconditioner, and

(c) Water cooler.

4. Electric Welding:

(i) Welding methods, principles of resistance welding, welding equipment.

(ii) Electric arc welding principle, characterstics of arc; carbon and metalic arc welding, power supply,advantage of coated electrode, comparison of AC and DC arc welding; welding equipment.

5. Electrochemical Processes:

(i) Need of electro-deposition.

(ii) Faraday's laws in electrodeposition.

(iii) Objectives of electroplating.

(iv) Description of process for electroplating.

(v) Factors governing electro deposition.

(vi) Equipments and accessories for electroplating plant.

(vii) Principle of anodising and its applications.

(viii) Electroplating on non-conducting materials.

6. Electric Traction:

(i) Concept and configuration of Electric drive and types of electric drive.

(ii) Advantage of electric traction.

(iii) Different systems of electric traction, D.C. and A.C. system.

(iv) Different accessaries for track electrification; such as overhead wires, conductor rail system, current collector-pentagraph.

(v) Electrical block diagram of an electric locomotive with description of various equipments and accessaries.

(vi) Electric braking,plugging, rheostatic and regenerative braking.

(vii) Differernt types of battery driven vechiles and their application.

7. Economic Consideration

7(a) Load estimation, load curves, load duration curve, demand factor, load factor, diversity factor, Plant capactiy factor, and utilisation factor, simple problems involving interpretation and application of above factors.

7(b) Cost of generation, fixed cost, running cost, cost per unit, effect of load and diversity factor on over all cost of generation. Economic load divison between power stations for a given load duration curve.

7(c) Tariffs : meaning of different tariffs and their application, block rate, flat rate, max. demand, and two part tariffs. Bill preparation.

8. ENERGY CONSERVATION :

Need for energy conservation, over view of energy management, Basic idea about energy audit.

3.9 ELECTRICAL MACHINE II

L	T	P
2	1	4

Rationale:

Knowledge of various types of electrical machines operate, maintain, test and repair/replace electrical machinery used in various industrial and domestic applications.

Knowledge of various parts and constructional details is also necessary when the diploma holder is placed in a manufacturing industry.

Thus to impart knowledge about the common types of electrical machines which a diploma holder deals with, are synchronous machines, induction motors, etc. Therefore these machines should be taught.

Sl. No.	Units	Coverage Time L	T	P
1.	Induction motor	16	8	-
2.	Synchronous motor	12	6	-
3.	F.H.P. motors	10	5	-
4.	Electric Drive	8	4	-
5.	Converting Apparatus	4	2	-
		50	25	100

1. Induction Motor

1 Rotating magnetic field for 3 ph. concept of motors and its reversing.

2 Construction and working of 3 ph. induction motor (squirrel cage and wound rotor motor). Double squirrel cage induction motor.

3 Rotor frequency, rotor e.m.f.,rotor current and rotor power factor.

4 Torque equation

5 Torque slip characterstics.

6 Principle and methods of speed control

7 Methods of starting of induction moter. On line, auto transformer, star delta manual/automatic starters for induction motor. Starter for slip ring ind. motor.

8 Application of induction motor .

9 Testing of motor as per I.S.

Performance of 3 phase induction motor with the help of circle diagram.

10. Losses and efficiency (simple problems only)

11. Phaser diagram of induction motor.

2. Synchronous Motor

Construction, working principle, effect of load on synchronous motor, vetor diagram of synchronous motor, effect of change in excitation on the performance of synchronous motor, V curves, torque & mechanical power developed, condition for max. mechanical power, synchronous condenser, hunting and its elimination, comparision between ind. motor and synch. motor, starting methods and uses of synch. motor.

3. F.H.P. Motors

1. Classification of F.H.P. motors

2. Production of rotating Magnetic field in 1 ph. motors.

3. Double revolving field theory.

4. Construction working and application of

(i) Capacitor motor (all types)
(ii) Shaded pole motor
(iii) 1 ph. synchronous motor
(iv) 1 ph. series and universal motor
(v) Servo Motor

4. Electric Drives :

(i) Advantages of electric drives.

(ii) Characterstics of different mechanical loads.

(iii) Types of motors used in electric drive.

(iv) Use of fly wheels for fluctuating load (only physical concept).

(v) Types of enclosures.

(vi) Methods of power transfer by devices like belt drive, gears, pulley.

(vii) Examples of selection of motors for particular loads.

(viii) Applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift.

(ix) Specifications of commonly used motors (squirrel cage induction motors, slip ring inductiom motors, AC series motors).

5. Converting Apparatus

Introduction to different types of converting apparatus e.g. metal rectifier etc.

ELECTRICAL MACHINE II LAB

1. To determine performance characterstics of a polyphase induction motor. (load v/s efficiency, load v/s power factor, load v/s slip)

2. To start a 3 phase induction motor and to determine its slip at various loads.

3. To determine V cuves of a synchrnous motor.

4. To connect and start an induction motor by using star delta starter, auto transformer starter, rotor starter and to change its direction of rotation.

5. To perform open circuit and block rotor test on a 3 ph. induction motor and to determine its efficiency.

6. Determination of performance curve and hence the coreloss of a single phase series motor.

7. Voltage and current ratio of metal rectifier.

8. To perform open circuit and short circuit test on a 3 ph. synchronous machine and to determine synchronous impedence and regulation at lagging/leading power factor.

9. Sequential operation of motors using timers.

10. Achieving high starting torque in case of 3 phase slip ring motor by increasing external resistance in rotor circuits and determine speed regulation at different loads

3.10 ELECTIVES

3.10 (a) CONTROL OF ELECTRICAL MACHINES

L	T	P
3	1	-

Rationale:

Control systems for electric motors have become very important particularly with reference to their proper performance and protection. These control systems may range from starting and stopping of electric motors to that of directing the energy flow in a completely automated factory. The arrangement in general, may involve one or more of such functions as rapid stopping (braking), reversing, speed changing, travel limits of machanical equipment (cranes, hoists, machine tools), timing of multimotor drives and the regulation of current torque, speed, acceleration and deceleration. The subject has become an important branch of electrical engineering.

The study of this subject would certainly build up confidence in the students who would like to join the industrial complex.

Sl.No.	Units	Coverage Time L	T	P
1.	Control components	12	4	-
2.	A.C. control circuits	12	4	-
3.	Control of synchronous motors	12	4	-
4.	Control of single phase motors	12	4	-
5.	Industrial control circuits	12	3	-
6.	Trouble shooting in control circuits	10	4	-
7.	Basic Concept of PLC	5	2	-
		75	25	

DETAILED CONTENT

1. Control components

1.1 Fuses and combination fuse switch units

1.2 Miniature circuit breaker

1.3 Contactors

1.3.1 Solenoid type
1.3.2 Clapper type

1.4 Over-load relays

1.4.1 Thermal over-load relay
1.4.2 Ratchet type over load relay
1.4.3 Magnetic over-load relay

1.4.4 Dash pot type oil filled relay

1.5 Timing relays

1.5.1 Thermal time delay relay
1.5.2 Pneumatic time delay relay
1.5.3 Synchronous motor-driven timer
1.5.4 Solid state timer

1.6 Phase failure relay

1.7 Push-buttons

1.8 Selector switches

1.8.1 (Two position)
1.8.2 (Three position)

1.9 Limit switches

1.9.1 Single side actuation type
1.9.2 Double side actuation type
1.9.3 Rotary cam type
1.9.4 Heavy duty limit switch

1.10 Proximity switches

1.11 Solenoid valves

1.12 Master controllers & drum switches

1.13 Pressure switches

1.14 Temperature controller (Thermostat)

1.15 Float switches

1.16 Mechanical brakes for motors

1.17 Control transformer

1.18 Rectifiers

1.19 Reactors

1.20 Capacitors

1.21 Symbols for various components

1.22 Control diagram

1.22.1 Two wire control circuit
1.22.3 Three wire control circuit

* Study of components in the Lab.

2. A.C.Control Circuits

2.1 Forward/reversing of 3 phase motors

3.2.1 With push-button inter-locking

3.2.2 With Auxillary contact inter-locking

2.2 Sequence starting of motors

2.3 Starting of multispeed squirrel cage motor

2.4 Dynamic braking of squirrel cage induction motor

2.5 Plugging of squirrel cage induction motor

2.6 Over-load protection of motors

2.7 Single phase protection

2.8 Over-temperature protection

2.9 Voltage stabiliser for 3 phase and single phase motors.

3. Control of Synchronous Motors

3.1 Prinicple of acceleration

3.2 Motor starter with field application by definite time relay

3.3 Motor starter with field control by polarised field frequency control.

3.4 Motor starter with feild application by slip frequency relay

3.5 Over-load protection scheme

4. Control of Single Phase Motors

4.1 Across the line starter

4.2 Reversal of universal motor

4.3 Speed control of universal motor

4.4 Starter for capacitor type split phase motor

4.5 Dynamic braking

5. Industrial Control Circuits

5.1 Heater control

5.2 Compressor motor control

5.3 Skip hoist control

5.4 Walking beam

5.5 Battery operated truck

5.6 Conveyor system control

5.7 Lift circuit

6. Trouble Shooting in Control Circuits

6.1 Analysing the problems

6.2 Major trouble spots

6.2.1 Fuse base
6.2.2 Loose connections
6.2.2 Faulty contacts
6.2.4 Incorrect wire markers
6.2.5 Combination problems
6.2.6 Low-voltage
6.2.7 Grounds

6.3 Procedures used in trouble-shooting

Troble shooting practice should be done in the lab.

7. Basic concept and application of PLC.

3.10 (b) PROCESS CONTROL AND INSTRUMENTATION

L	T	P
3	1	-

Rationale

The technician has the responsibility of using and maintaining electronic test equipments for measurement , design ,testing and trouble shooting. With the introduction of new techniques of process control in modern industries, the use of transducing elements in medicine, agriculture, and other non-engineering areas, the task of the technician has become varied and different from the previous task of measurement only.

The course aims to develop appreciation and understanding of the use of transducers, data handling and transmitting and measurment of a variety of physical quantities.

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	15	5	-
2.	Control system components	15	5	-
3.	Instrument transformer	15	5	-
4.	Transducer	15	5	-
5.	Process instrumentation	15	5	-
		75	25	

1. Introduction:-

Process and process characterstics, Block diagram of a general open and closed loop process. Control system and application.

2. Control system components :

Brief description and working of a potentiometer, differential transformer servo motors. Tacho generator, eddy current clutches relay contactors timing relay temperature switches saturable core reactors & its use as magnetic amplifier.

3. Instrument Transformer

Theory of current and potential transformers ratio & phase angle errors, effect of variation of Power factor, secondary burden and testing of C.T. & P.T.

4. Transducers

Definition of transducers, classifcation of transducers & its application. Active & passive type their use for measurement of mechanical and electrical quantitites, such as speed pressure strain displacement volume temperature magnetic flux and

humidity. Application of transducers for instrumentation & control. Selection criterea based on static and dynamic characterstics.

5. Process Instrumentation:

Functional block diagram of instrumentation system. Description of each block. Description of practical circutis for the following:

1. Temperature meausrements: General, heat transfer modes, temperature measuring devices like thermocouples,
Pyrometer, resistance thermometer.

2. Flow measurement: General, flow meters: Venturi meter, orifice plate, pitot tube, rotameter, turbine meter, electromagnetic meter & mass flow measurement.

3. Pressure measurements: General, dynamic performance, pressure receiver and transmission line, input impedence, energy level of pressure pickups, pressure pick ups. Manometer, pressure elements differential pressure.

4. Vibration measurements: Vibration measurement systems, analysis of acceleration data.

5. Strain measurements: Requirements for strain measurement, strain gauges, selection of gauges, general strain measurements.

3.10 (c) ELECTRIC TRACTION

L	T	P
3	1	-

Rationale

Now a days electrical energy finds major application in electric traction besides steam and deisel locomotives. Therefore a diploma holder is required to have elementary knowledge of electric drives used in traction accelerating and breaking arrangments at the control pannel.

Sl. No.	Units	Coverage Time L	T	P
1.	Introduction	5	1	-
2.	Electric traction drives	8	3	-
3.	Power supply for traction	8	2	-
4.	Mechanics of traction	8	2	-
5.	Rectification equipment	8	2	-
6.	Overhead equipments	8	3	-
7.	Track circuit	10	4	-
8.	Supervisory remote control	10	4	-
9.	Rail and return path	10	4	-
		75	25	-

1. Introduction:

Electric traiction system and its advantages over other system, types of electric traction systems. Traction systems for India.

2. Electric traction drives:

Suitability of electric traction drives- D.C. series motor, A.C. series motor, 3 phase induction motor, characteristics of electric traction drives, special design requirements, methods of starting and speed control, different methods of braking, plugging, rheostatic, regenerative.

3. Power supply of electric traction:

Different systems of power supplies, their chronological evalution, power supply arrangement i.e. traction substation major equipement transformer, circuit breaker, interuptor, protection system, remote control system, design consideration.

4. Mechanics of traction

System of units, speed time curves, their construction, simplification and interpretation for main line, suburban routs, tractive effort, specific energy consumption and factors effecting it. Weight

transfer due to torque coefficient of adhesion.

5. Rectification Equipment

Equipments required for rectification their brief theory and working.

6. Over head Equipments

Design aspects of over head equipments catenary and its types, practical aspects of working, maintenance of over head equipments, current collection system, their requirements.

7. Track Circuits

D.C. and A.C. track circuits, signals for traffic control,

8. Supervisory Remote Control

System of remote control, its advantages, mimic diagram, remote control system and network remote control centre (R.C.C.)

9. Rail and Return Path

Earth return protection of under ground equipment, Negative booster, voltage distribution on rails.

3.10 (d) RENEWABLE SOURCES OF ENERGY

COURSE RATIONALE

"Energy" in any form is the focus of attention for an Engineer or a Technologist. Production and storage of energy from all possible, feasible and viable sources in the concern of all of us today, Deplition of fossil fuels in the near future leads to global darkness and an unimaginable state of living.

In the backdrop of energy crisis, which may assume gigantic dimensions, it is apt to us to create awareness in the students of engineering at all levels, the need of harnessing renewable sources of energy, and to teach them the methods of storing and utilisation of such energy.

With this view the subject, renewable sources of energy, is included in the curricula of the final year of electrical engineering diploma cource as optional subject.

Sl.No.	Units	Coverage L	T	Time P
1.	Introduction	05	01	-
2.	Solar Energy	15	04	-
3.	Biomass	10	03	-
4.	Wind Energy	12	04	-
5.	Microhydel Energy	06	02	-
6.	Tidal Energy	06	02	-
7.	Geothermal Energy	08	03	-
8.	Appropriate Technology	08	03	-
9.	Bio Diesel	05	03	-
		75	25	-

COURSE CONTENTS

1.0 INTRODUCTION:

- 1.1 Global energy scenario
- 1.2 Depletion trends of fossil fuels
- 1.3 Need for alternative sources of energy
- 1.4 Differences between renewable and non-renewable sources of energy examples thereof.

2.0 SOLAR ENERGY:

- 2.1 Concept
- 2.2 Solar radiation
  - * solar radiation at the earth surface
  - * direct and diffused radiation
  - * solar constant
- 2.3 Basic Earth angle
  - * Altitude and Latitude angle
- 2.4 Solar radiation geometry
  - * Declination angle
  - * Azimuth angle

* Zenith angle
* Solar altitude angle
* Tilt angle
* Hour angle
* Sun rise time and sun set time and day length

2.5 Solar radiation measurement
* Pyroheliometer
* Pyranometer
* Solar radiation data
* Estimation of solar radiation(hourly, daily and monthly)(Introduction)

2.6 Fundamental heat transfer equation

2.7.1 Flat plate collector
* Working principle
* Types of plate collector
* Sources of losses from a flat plate collector
* Collector efficiency(concept)

2.7.2 Concentrating collector

2.8 Application of flat plate collector

Basic Principles of these devices
* Solar cooker
* Solar water heater
* Solar dryer
* Solar distillation unit

2.9 Advantages and disadvantages of concentrating collector over flat plate collector

2.10 Application of solar concentrating collector like solar water heating, space heating and cooling and electric power generation(Basic principles)

2.11 Solar photovoltaics system
* Principle and Physics of PV cells
* PV module,panel and array
* Series and parallel connection
* Power output calculations
* Operation and maintenance of PV systems
* Solar Battery- construction, operation, maintenance and effect of sp. gravity of electrolyte.

3.0 BIOMASS:

3.1 Introduction to biomass energy and photosynthesis

3.2 Sources of biomass

3.3 Fuel characteristics of biomass-moisture content, proximate and ultimate analysis of fuel

3.4 Biomass conversion: Thermal/Biological

3.5 Biomass pyrolysis

3.6 Charcoal making process

3.7 Gasification and main types of gasifiers

3.8 Combustion of biomass: review of combustion equations-calculations of air requirement flue gas analysis

3.9 Working of anaerobic digestors

3.10 Different types of bio gas generating plant
* Fixed Dome Type
* Floating Dome Type
* Janta Model Type

* Deen Bandhu Model

4.0 WIND ENERGY:

4.1 Wind map of India

4.2 Intensity of wind energy

4.3 Types of windmills

4.3.1 Vertical axis windmills Darrius and Sarious types

4.3.2 Horizontal axis windmills

4.4 Applications of wind energy

4.4.1 Water pumping

4.4.2 Electric power generation

5.0 MICROHYDEL ENERGY:

5.1 Meaning and concept of microhydel power

5.2 Site selection for a microhydel project

5.3 Methods of power generatio in a microhydel power station

6.0 TIDAL ENERGY:

6.1 Meaning of wave and tidal power

6.2 Methods of power generation from waves

6.3 Methods of power generation from tides

7.0 GEOTHERMAL ENERGY:

7.1 Potential and classification of geothermal energy and equalayer

7.2 Conversion of geothermal energy into electric power

7.2.1 Components of a power station (Geothermal)

7.2.2 Study of battery storage system

7.3 Multipurpose uses

* Crop Drying
* Bathing
* Refrigeration

8.0 Appropriate Technology:

8.1 Introduction: Concept of appropriate technology, modern technology v/s appropriate technology, its need, review of the traditional technologies and their possible modifications.

8.2 Water lifting devices: Traditional methods used in the rural areas for lifting water.Rahat, inertia pumps, low lift pumps, diaphram pumps, use of appropriate technology in their design and construction. Hand and pedal operated devices, water pumping wind mills.

9. Bio Diesel

9.1 "Jatropha Karkas" oil as a substitute of diesel fuel.

3.10 (e) HIGH VOLTAGE ENGINEERING

L	T	P
3	1	-

Rationale:

High voltage principles form an important and essential part of the Electric Power System. The voltage level at which power is transmitted whether it is AC or DC is always on the increase. High voltage testing of elecrical equipment is an important field where a diplima engineer may be employed. This can be in a high voltage laboratory of industry manufacturing high voltage equipment or in a electical supply undertaking resposible for installation, erection and maintenance of high voltage transmission.

S.N.	Units	Coverage Time L	T	P
1.	Topic 1	9	3	-
2.	Topic 2	9	3	-
3.	Topic 3	9	3	-
4.	Topic 4	9	3	-
5.	Topic 5	19	6	-
6.	Topic 6	20	7	-
		75	25	-

DETAILED CONTENTS:

1. BASIC PROCESS OF CONDUCTION AND BREAK DOWN IN SOLID, DIELECTRICS :

1. Classification of insulating materials.
2. The di-electric constant.
3. Properties of dielectric.
4. Dielectric Break-down
5. Intrinsic break-down and test apparatus to measure strength of solids.
6. Frohlic theory of break-down for crystalline dielectric.
7. Band theory of break-down for amorphous dielectric.
8. Thermal break-down and time to thermal break-down.
9. Discharge Break-down.
10. Electro Chemical Break-down.
11. Measurement of dielectric loss or loss angle.
12. Commonly used solid dielectrics.

2. BASIC PROCESS OF CONDUCTION AND BREAK DOWN IN LIQUID AND GASEOUS DIELECTRICS :

1. Properties of transformer oil.
2. Conductivity of fluids.
3. repeated discharges through liquids.
4. Behaviour of fluids under non-uniform fields.

5. Corona voltage, visual corona and corona at sub-critical voltage.
6. Effects of corona.
7. Discharge through gases.
8. Gases under varying pressure and temperatures.
9. Gases under high vacuum.
10. Some common gaseous dielectric.

3. HIGH VOLTAGE GENERATION :

3.1 Power Frequency High Voltage Generation :

1. High Voltage Transformers.
2. Cascaded Transformers.
3. Senes Resonance Method.
4. Resonance Transformers.

3.2 High Voltage DC Generation :

1. Rectifiers.
2. Voltage Doubling Circuits.
3. Voltage Multiplier Circuits.
4. Electrostatic Generation.

3.3 Generation of Impulse Voltages :

1. Basic Impulse Circuit.
2. Single Stage Impulse Generators.
3. Multistage impulse generators.
4. Generation of switching surges.
5. Generation of high frequency voltages.

4. CONSTRUCTIONAL DETAILS OF CIRCUITS ELEMENT :

1. High Voltage Capacitor.
2. High voltages Resistors.

5. MEASUREMENT OF HIGH VOLTAGES :

5.1 Power Frequency Measurement :

1. Transformer Ratio.
2. Potential transformers.
3. Potential dividers.
   - Resistance Potential Dividers
   - Capacitance Potential Dividers.
4. Ryall crest voltmeter
5. Sphere-gap method.
6. Uniform field gap method.
7. Rod gap.
8. Needle gap.
9. Electrostatic Voltmeters.
10. Quadrant Electrometer.
11. Ellipsoidal Voltmeters.

5.2 Measurement of DC High Voltage - Generating Voltmeter.
5.3 Measurement of impulse voltages.

6. HIGH VOLTAGE TESTING :

6.1 Transformer Testing.
6.2 Line Insulators Testing
- Mechanical Strength
- Porosity
- Power Frequency Dry Flashover Voltage
- Power Frequency Wet Flashover Voltage
- Impulse Voltages Flashover Test
- Puncture Voltage

6.3 Testing of Power Cables

- Type approval Tests.
- Development Tests.

6.4 Testing of Power transformers - Connection for transformers

6.5 Power Capacitor Testing

- Impulse Test
- Discharge Test

6.6 Isolator Testing
- Impulse Voltage Test
- Power Frequency Voltage Dry Test
- Power Frequency Voltage Wet Test

6.7 Current Transformer Testing

- Power Frequency High Voltage Test
- Impulse Voltage Test

6.8 Testing of voltage transformer-induced voltage test.

LIST OF BOOKS

1. Anderson, J. C.- "Dielectrics"- Chapman and Hall, London.
2. Blume L.F. - "Transformer Engineering"- John Wiley, New York.
3. Meek J. M. and Cragg JD- "Electric Break Down in gases, Oxford
i. IS 731(1971) Porcelain Insulator
ii. IS 1180(1979) Distribution Transformer
iii. IS 1876(1961) Voltage Measurement by Sphere Gap
iv. IS 2026(1962) Power Transformers
v. IS 2070(1972) Impulse Voltage Testing
vi. IS 2071(1974) High Voltage testing
vii. IS 2165(1973) Insulation Co-ordination
viii. IS 2516(1966) AC Circuits Braker
ix. IS 2705(1964) Current Transformers
x. IS 3156(1965) Voltage Transformers
xi. IS 6792(1972) Determination of Electrical Strength of insulating oils.

4. Power System Transients and High Voltage Principles- B.R. Gupta and L. K. Khera.

3.10 (f) ENERGY MANAGEMENT

L	T	P
3	1	-

Rationale:

One of the reasons for India not been able to catch up with the desired extent of modernization of industrial processes in light of challenges posed by multinationals is the non-availability of required energy supply. The solution primarily lies in tapping all possible energy generation sources but efficient use of available energy is also important. Energy management focuses on these aspects and the course will develop a awareness amongst the diploma engineers and will enable them to practice of the energy management techniques in whatever field they are engaged in.

S.N.	Units	Coverage L	Time T	P
1.	Energy Management	15	5	-
2.	energy Conservation	15	5	-
3.	Energy Efficient Devices	23	7	-
4.	Energy Audit	15	5	-
5.	Environmental Impact Assessment	7	3	-
		75	25	-

DETAILED CONTENTS:

1. ENERGY MANAGEMENT :

1. Overview of energy management, need for energy conversation (Started with oil crisis). Environmental Aspects, Alternative sources of energy.

2. Need for Energy consveration with brief description of oil and coal crisis.

3. Environmental aspects.

4. Alternate sources of energy.

5. energy efficiency-its significance.

2. ENERGY CONSERVATION :

1. Energy conservation in Domestic Sector - Lighting, Home appliances.

2. Energy conservation Inindustrial Sector - Motors, Industrial lighting, Distribution system, Pumps, Fans, Blowers, etc.

3. Energy conservation in Agriculture sector, Tubewell pumps, Diesel generating sets, Standby energy sources.

4. Macro level approach for energy conservation at design stage.

3. ENERGY EFFICIENT DEVICES :

1. Need for energy efficient devices.
2. Initial cost versus life cycle cost analysis on life cycle basis.
3. Energy efficient motors as compared to standard motors.
4. BIS specification for energy efficient motors, Salient design features.
5. Efficiency as a function of load, safely margins.
6. Energy efficient lighting system different sources, lumens/watt, LEDs, role of voltage on efficiency.
7. Distribution system- Optimum cable, amorphous core transformer, role of power factor, use of compansating capacitor-manual and automatic, location of capacitors.

4. ENERGY AUDIT :

1. Energy Audit Methodology
2. Efficiency of energy conversionprocesses, monitoring system.
3. Specific energy consumption- Three pronged approach, Five tuning, Technical up.
4. Gradation, Avoidable losses.
5. Case studies of energy audit of distribution system, AC motors, Industries.
6. Organisation of energy audit activities.

5. ENVIRONMENTAL IMPACT ASSESSMENT :

1. Need for Environmental Impact Assessment.
2. Standard format for assessment and its completion.
3. Evaluation of the assessment.

LIST OF BOOKS

1. Manual on energy efficiency at design state-CII Energy Management Cell.
2. Manual on energy efficiency in pumping system-CII Energy Management Cell.
3. Manual on variable speed drives for energy efficiency -CII Energy Management Cell.
4. Energy conservation case studies in Ceramic industry, Sugar industry, Fertilizer industry, Cement industry-CII Energy Management Cell, etc.

SUBJECTS FOR ELECTRICAL ENGG.(INDUSTRIAL CONTROL)

3.11 INDUSTRIAL CONTROL-I

L	T	P
3	1	4

Rationale

Electric motors are extensively used in all types of industries because of high efficiency and easy control. Most of these motors for precise control use power electronics equipment. An Electrical Engineering diploma holder has to deal with manually operated old machines and automatic controlled modern machines and equipment. To deal successfully with wide spectrum of requirements in the industry, the pass out diplima holders should have adequate knowldege of control components, conventional electromagnetic controllers, conventional and solid sate control of electric machines and electric drives. The study of this subject would certainly build up confidence among the students to face the challenges of industry.

Sl.No.	Units	Coverage Time L	T	P
1.	Speed Control of D.C. Motors	12	4	-
2.	Speed Control of Three Phase Induction Motor.	15	5	-
3.	Solid State Control of Synchronous Motors.	12	4	-
4.	Solid State Control of Single Phase A.C. Motor	12	4	-
5.	Control Components	12	4	-
6.	Electromagnetic Controllers	12	4	-
		75	25	100

DETAILED CONTENTS

1. Speed Control of D.C. Motors:

(a) Conventional Control:

Methods of Speed control, Armature circuit resistance control, Field control, Motor voltage control (Ward Leonard methods only).

(b) Solid State Control:

Half controlled and fully controlled rectifier fed schemes (Single Phase and Three Phase) for D.C. separately excited and Series motors, Soild state ward leonard schemes, Chopper control scheme (Time Ratio Control Only), Block diagram speed feedbacks, Comparison, Current and Speed feedbacks, Comparison of proportional and proportional plus integral control (Simple Numericals Only).

2. Speed Control of Three Phase Induction Motors:

(a) Conventional Control:
Methods of speed control, Variable terminal voltage control, Variable frequency control, Pole changing control, Rotor resistance control, Concept of emf injection in rotor circuit.

(b) Solid State Control:

Line A.C. voltage controller scheme, Voltage source fed scheme, Pulse width modulated fed inverter scheme, Comparison of VSI fed and CSI fed schemes, Cyclo Converter fed scheme, Static rotor resistance scheme, Slip power recovery scheme. Block diagram explanation of closed loop control scheme, Applications of various schemes.

3. Solid State Control of Synchronous Motor:

Self commutated inverter fed scheme, Voltage source inverter fed scheme, Block diagram explanation of closed loop scheme.

4. Solid State Control of FHP AC Motors/DC Motors:

D. C. Motor Control:

Half wave and Full wave single thyristor schemes.

A. C. Motor Control:

Triac Control Scheme, Single plase A. C. voltage controller scheme.

5. Control Components:

Relays (General purpose, Over load, Timing), Contactors (Solenoid Type, Clapper Type), Fuses and combination fuse switch units, Miniature circuit breaker, Push buttons, Limit switches, Phase failure relay, Selector switch, Master controller and Drum switches.

6. Electromagnetic Controllers:

Symbols for various components, Schematic control diagram, Wire control diagram.

Forward/reverse operation of three phase squirrel cage induction motor, Slip ring induction motor starter plugging of squirrel cage induction motor, dc shunt motor starter, Synchranous motor starter, Starter for capacitor type split phase motor, Reversal of universal motor.

INDUSTRIAL CONTROL-I LAB

List of Practicals

1. Speed control of D. C. shunt motor using Armature Voltage Control method (Ward Leonard method of speed control).

2. To plot speed - Torque characteristics of D. C. shunt motor at different firing anyles when the motor is fed by a fully controlled/half controlled thyrister rectifier.

3. To plot speed- Torque characteristics of D.C. shunt motor fed by a chopper using time ration control technique only.

4. To plot speed- torque characteristics of Three Phase cage induction motor at two different frequency with the help of cycloconverter.

5. Speed control of FHP motor using Solid State A. C. Voltage Controller.

6. Study of Dynamic braking of D. C. shunt/separately excited motor and to see the effect of resistance on braking time of the machine.

7. Study of Plugging method of Induction motor braking and to study the effect of variation of supply voltage on braking time.

8. Study of Y/D autotransformer starting methods of Three Phase induction motor starting.

3.12 INDUSTRIAL CONTROL-II

L	T	P
3	1	-

Rationale

The Present civilization is closely interwoven with the utilization of electrical energy. All the spheres of human life are greatly influenced by electrical energy. In industrial sphere too the use of electrical energy has become essential to convert it in the form of mechanical heat and light energy for the specific purposes with the advent of solid state technology. Old controllers and equipments are now being replaced in industry. A diploma holder in Electrical Engineering has to bear the responsibilities to plan and design to select equipments processes and installations in different situations.Keeping the above objectives in view, attempts have been made to ensure that the knowledge acquired be adequate in various fields as per the job requirements.

Sl.No.	Units	Coverage Time L	T	P
	PART - 'A'			
1.	Electric Drives	10	3	-
2.	Electric Traction	10	3	-
3.	Electric Braking	10	3	-
4.	Refrigeration & Air Conditioning	15	4	-
	PART - B			
1.	Industrial Control Circuits	15	6	-
2.	A. C. Control Circuits	15	6	-
		75	25	-

DETAILED CONTENTS

1. Electric Drives:

(i) Definition of Electric drives, Block diagram explanation of conventional and Modern electric drives, Advantages of electric drive.

(ii) Types of electric drive - Group, Individual and Multimotor types and their applications.

(iii) One quadrant, Two quadrant and Four quadrant electric drive with their applications.

(iv) Constant torque and constant power control of electric drive and their use.

(v) Chacteristics of different mechanical loads (Variation of torque/power with respect to speed and time only).

(vi) Types of motors used in electric drive and their relative merits and demerits.

(vii) Use of flywheels for fluctuating load (Only Physical Concept).

(viii) Determination of motor rating for continuous, short time and intermittent duty (Constant speed applicaiton only), Simple Numerical Problems.

(ix) Types of enclosure and their use.

(x) Necessity of mechanical power transfer; Methods of power transfer by devices like belt drive, pulley drive and gear drive with their field of applications.

(xi) Criteria for the selection of motors for particular loads; selection of motors for general workshop, crane and lift, textile mill, paper mill, steel mill and mine winders, printing press.

(xii) Specification of commonly used motors.

2. Electric Traction:

(i) Salient features of electric traction.

(ii) Different accessories for track electrification, such as overhead wire, Conductor rail system, Current collector pantograph.

(iii) Electrical block diagram of an electric locomotive with description of various equipments and accessories.

3. Electric Braking:

Concept of Electric Braking, Merits and Demerits of electric braking over mechanical braking, Methods of Electric braking.
Plugging rheostatic and regenerative braking as applied to dc motors and three phase induction motors (Conventional and Solid state schemes), Relative comparison of merits and demerits.

4. Refrigeration and airconditioning;

(i) Concept of refrigeration and airconditioning.

(ii) Brief description of vapour compression refrigeration cycle.

(iii) Description of electrical circuit used in

(a) Refrigerator,

(b) Airconditioner, and

(c) Water cooler.

PART - B

1. INDUSTRIAL CONTROL CIRCUITS:

- Heater control
- Compressor motor control
- Skip hoist control
- Walking beam
- Battery operated truck
- Conveyor system control
- Lift circuit

2. A.C.CONTROL CIRCUITS:

- Forward/reversing of 3 phase motors
  - With push-button inter-locking
  - With Auxillary contact inter-locking
- Sequence starting of motors
- Starting of multispeed squirrel cage motor
- Dynamic braking of squirrel cage induction motor
- Plugging of squirrel cage induction motor
- Over-load protection of motors
- Single phase protection
- Over-temperature protection

3.13 CONTROL SYSTEM & PROCESS APPLICATION

L	T	P
2	1	-

Rationale:

Control system has pronounced impact on the industrial processes almost all sophisticated automatic controls. A diploma holder with specialization in "Industrial Electronics and Control" has to bear the responsibilities of operation and maintenance of these plants and equipments in industry. Therefore the contents of this course have been selected on the basis of demand of modern industries. This subject deals with various control system devices and components, performance of control systems and various controllers used for improving the performance.

Sl. No.	Units	Coverage Time L	T	P
1.	Introduction	4	2	-
2.	Components and Devices Used In Control System.	6	3	-
3.	Input Output Relationship of Simple Control System Components	6	3	-
4.	Stability Cirterion	6	3	-
5.	Performance of Control System	8	4	-
6.	Automatic Control Actions	6	3	-
7.	Controllers In Process Control	8	4	-
8.	Descrete Data System	6	3	-
		50	25	-

Detailed Contents

1. Introduction:

Need of automatic control, Concept of open loop and closed loop control, Block diagram of feedback control system and its basic elements, definition and explanation of following control system.

(i) Linear and Non-Linear Systems.

(ii) Continous and discrete Systems.

(iii) Static and Dynamic Systems.

(iv) Single Input Single Output (SISO) System and Multiinput Multioutput (MIMO) System.

Process and Process characteristics, Analogy with electrical system, Concept of process time delay.

2. Components & Devices Used In Control System:

Brief description and working of potentiometer, self balancing potentiometer, differential transformer, synchros, servometors, tacho generators, saturable core reactor and magnetic amplifier, hydraulic and pnenmatic flapper valves, pneumatic transducer.

3. Input Output Relationship of System & Control system Components:

(i) Concept of transfer function and its use in control system.

(ii) Derivation of transfer function of following systems and components.

(a) Simple RC low pass network.
(b) Lag, Lead, Lag-Lead compensating networks.
(c) First order thermal system and fluid level system.
(d) General Feedback Control System.
(e) DC servometer and DC Tachogenerator.

4. Stability Cirterion:

Bounded Input and Bounded Output (BIBO) System, Concept of Stability, Routh and Nyquist criteria and their applications to simple system.

5. Performance of Control System:

(i) Step, Ramp, Pulse and sinusoidal type of inputs and their Laplace Transforms.

(ii) Time domain response of First order ans Second order system with step input.

(iii) Definitions of Rise time, Peak overshoot, Settling time, Natural frequency and Damping Ratio pertaining to second order system.

(iv) Initial value and final value theorems and their use in control systems.

(v) Types of feedback systems and error constants.

(vi) Frequency response of simple systems using Bode plot.

(vii) Relative stability, Gain margin and Phase margin explanation with reference to Nyquist plot and Bode Plot.

6. Automatic Control Actions:

Control actions, Types of control actions, Two position control (On/Off action), Proportional, Proportional plus integral, Proportional plus derivative, Propertional plus

integral plus derivative action.

7. Controllers In Process Control:

(a) Electric Controller:

Working principle and Operation of Two position electric controller, Few simple circuits i.e. Photo electric, Galvanometric, Thermometer type, Propertional controller.

(b) Electric Controller:

On-OFF controller, Proportional, Proportional plus integral, Propertional plus integral plus derivative.

(c) Hydraulic & Pneumatic Controllers:

Principle and working of hydraulic controllers (Proportional and Proportional integral), Pneumatic P-I-D controller comparison of electronic, Hydraulic and Pneumatic controllers.

8. Discrete Data System:

Discrete signal system, Discrete line system, Block diagram explanation of digital data system, Representation of microprocessor controlled system, as a digital data system, Concept of sampling, Analog to digital converter, Sample and hold circuit, concept of desampling, Digital to analog converter.

3.14 MICROPROCESSORS DEVELOPMENT SYSTEM

L	T	P
2	1	4

Rationale :

Microprocessor has brough a revolution in the electronic field. Miniaturisation and reliability are two major factors which have made electronic appliances versatile. Computers, pocket calculators and precision instrumentation could become possible and polular only due to microprocessor. A student equiped with the basic knowldege of different types of microprocessors and their variety of applications willprove useful to the industry and he can also responed to entreprenurial activeties.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage L	T	Time P
1.	Introduction to Microprocessor based system	2	1	-
2.	Structure of 8085 Microprocessor	7	4	-
3.	I/O Operating (8085 Microcomputer)	7	4	-
4.	I/O Devices (8085 Microprocessor)	8	4	-
5.	Microprocessor Application	8	4	-
6.	Other Microprocessor & Micro controller	8	4	-
7.	Microprocessor Systems	5	2	-
8.	Testing & Debugging the Microprocessor based system	5	2	-
		50	25	100

DETAILED CONTENTS

1. INTRODUCTION TO MICROPROCESSOR BASED SYSTEMS :

1.1 Evolution of Microprocessors
1.2 General applications of Microprocessor
1.3 Programming Microprocessors

2. STRUCTURE OF 8085 MICROPROCESSOR:

2.1 (a) Registers.

(b) Address/Data bus.

(c) Control bus.

(d) Interrupts.

2.2 Time multiplexing of address/data bus.

2.3 Concept of stack.

(a) LIFO structure.

(b) Safe for saving required data.

(c) Role in calling subroutine.

2.4 Timing diagram.

(a) Memory cycles.

(b) Opcode fetch.

(c) Memory read cycle.

(d) Memory write cycle.

(e) I/O read/write cycle.

3. I/O OPERATING (8085 MICROPROCESSER):

3.1 Programmmed I/O

(a) Using I/O port on IC chips.

(b) Programming the ports on IC chips.

(c) No hand shaking in data transfer.

3.2 Software interrupts.

(a) Restart interrupts.

(b) Vectored interrrupts.

(c) Use of software interrupts.

3.3 Interrupts.

(a) Interrupts levels.

(b) Interrupt circuits.

(c) Interrupt instructions.

(d) Extending interrupt system.

3.4 Serial input/output.

(a) RIM and SIM instructions.

(b) How to transmit parallel data serially out.

3.5 Direct memory access scheme.

(a) Need for DMA.

(b) Application of DMA transfer.

(c) Hardware logic used for DMA.

(d) Brief idea about DMA controller chips.

4. I/O DEVICES:

4.1 Some read/write memory chips.

(a) 8155/8156.

(b) Use of I/O ports on these chips.

(c) Use of Timer.

(d) 2114,2148,2164

4.2 A/D and D/A Converters.

(a) Use A/D and D/A converters

(b) D/A converters using R-2R

(c) Sucessive approximation

(d) Up, Up/down counter type A/D converters

(e) Basic concept of parallel A/D conveters

(f) Microprocessor compatible A/D and D/A converters DACO8, AD 7524, AD 7574.

(g) Sample and Holad chip NE 5537

4.3 Programmable peripheral interface chip.

(a) Structure of 8255.

(b) Programming of 8255.

(c) Selection of modes and hand shaking modes.

(d) Use of BIT set/reset from of port c.

4.4 Other support chips.

(a) Timer 8253.
(b) Interrupt controller 8259.
(c) Chip Like 8237 DMA controller

5. MICROPROCESSOR APPLICATION :

5.1 Microprocessor based Data Aquisition system.

5.1.1 Analog to Digital converters (0800,0808,0809) interfacting

5.1.2 Digital to Analog converters (0800,0808) interfacing

5.1.3 Seven regment display FND 500, 503, MAN 72

5.1.4 Display of alphanumeric characters.

5.2 Microprocessor based protective relays :

- Over Current
- Impedance
- Directional
- MHO relay

5.3 Measurement of electrical quantities using microprocessor :

- Voltage
- Current
- Frequency
- Phase Angle
- Power Factor
- Reactance
- KVA
- KVAR
- KWH

5.4 Measurement based control of firing circuit of thyristor.

- Temperature
- Strain
- Deflection
- Speed

5.5 Mecroprocessor based control of firing circuit of thyristor.

6. OTHER MICROPROCESSOR AND MICROCONTROLLER :

6.1 Comparison of 8085 with Z_80 and 8088, 68000 in terms of

- Bus structure.

- Architecture.

- Interrupts.

- Speeds.

- Memory Addressing

6.2 Single chip Micro Computer : 8748,8051,8096 and 8044

7. MICROPROCESSOR SYSTEMS :

7.1 Master/Slave distributed systems

7.2 Multiple Master distributed systems
7.3 IEEE 488/GPIB interface

8. TESTING AND DIBUGGING THE MICROPROCESSOR BASED SYSTEMS :

8.1 Tools for hard ware checks.
8.2 In circuit emulators.
8.3 Common faults and rectification (use of debugger)

MICROPROCESSORS DEVELOPMENT SYSTEM LAB

List Of Practicals

1. Assembly language programming :- Programming of simple problems.

2. Simple programming problems using 8085,8086 microprocessor. Trainer kit to gain competence in the use of

   (a) 8085 Instruction set.

   (b) Support chips or 8085.

   (c) Interfacing ADC/DAC chips IS 8085

   (d) Interfacing of Display Devices (Seven Segments)

   (e) Measurement of physical quantities like temperature, strain

   (f) Speed control of stepper motors

   (g) Programming of 8051 controller

3.15 ELECTRICAL & ELECTRONICS INSTRUMENTATION

L	T	P
2	1	4

Rationale:

Electrical and Electronics equipment and devices are widely used in industrial control because of their excellent performance in analysing storing and displaying. Therefore all the non-electrical quantities like temperature, pressure, speed etc. are converted in the form of equivalent electrical signals. These signals are conditioned and then either stored, displayed or used for control in real time systems. A passout diploma holder with specialization in Industrial Electronics and Control has to bear responsibility of handling and maintaining these equipment.

The course aims to develop appreciation and understanding of the use of transducers, signal conditioners, recorders and display devices.

Sl.No	Units	Coverage Time L	T	P
1.	Instruments Transformers	6	3	-
2.	Transducers	14	7	-
3.	Data Acquisition System	6	3	-
4.	Recorders	8	4	-
5.	Display Devices	6	3	-
6.	Electronics Equipments	10	5	-
		50	25	100

DETAILED CONTENTS

1. Instruments Transformers:

Theory of current and Potential transformers, Ratio and Phase angle errors, Secondary burden, testing of C. T. and P. T.

2. Transducers:

Definition of transducers, Classificaion of transducers, Application of transducers for instrumentation and control, Selection cirterion, Block diagram of a general instrumentation system. Description of practical circuits for the following.

(a) Temperature Measurement:

Concept of temperature measurement, Temperature measuring devices like thermo couples, Pyrometers, Resistance thermometers.

(b) Pressure Measurement:

Concept of pressure measurement, Pressure sensing devices like Diaphragm, Force balance, Bellows, Bourden tube, Pressure gauges, Pressure transmitters.

(c) Speed Measurement:

Tachometer, AC and DC tachogenerators, Stroboscope, Magnetic pick up, Shaft encoders.

(d) Strain Measurement:

Concept of strain measurement, strain gauges.

(e) Other Transducers:

Simple transducers for the measurement of magnetic flux, flow and level.

3. Data Acquisition System:

General concept, Importance of data acquisition system for instrumentation, Analog and digital data acquisition system. Introduction of microprocessor in data acquisition system.

4. Recorders:

Necessity of recorders, Basic requirements of a recording system, Classification of recorders, Strip chart and X-Y recorders, Ultra violet recorder, Magnetic tape recorder.

5. Display Devices:

Classification of display devices, working principle and typical use of various display devices like Cathode Ray Tube, Light Emitting Diode, Liquid crystal displays, Gas discharge plasma display, electro lumenscent displays.

6. Electronic Equipments:

Block diagram explanation of function generator and regulated power supply, Basic working principles of switched mode power supply and uniterrupted power supply, Instrumentation amplifiers and its applications.

ELECTRICAL & ELECTRONICS INSTRUMENTATION LAB

DO ANY TEN EXPERIMENTS

1. Measurement of speed of a Motor/Fan by electronic Stroboscope method/Electronic Tachometer/Digital Indicator/Hand Tacometer and to compare the results.

2. Measurement of temperature by Dial thermometer, Bimetallic thermometer and Resistance thermometer.

3. A. Measurement of temperature by different thermocouple such as Iron Constautan, Cr/Al, Pt-Pt/Rh.

   B. Calibration at Ice and Boiling Water Temperature.

4. Calibration of digital temperature indicator using Ice and Boiling Water.

5. To study the construction and operation of electromagnetic flow meter.

6. To study temperature recorder and temperature recording by temperature recorder.

7. Measurement of flow by rotameter.

8. To measure high voltage and current with the help of PT and CT.

9. To record the pressure by recording gauge.

10. To calibrate pressure gauge using Dead Weight Tester.

11. Measurement of pressure by Bourden Tube pressure gauge or any other method.

12. To measure liquid level by Float method and Air bubbler method.

13. To study the construction and operation of level limitting switches.

14. Determination of Ratio and Phase angle of a CT.

15. To fabricate a regulated power supply and to observe its output on a CRO.

SUGGESTED TOPICS FOR ECOLOGY AND ENVIRONMENTAL AWARENESS CAMPS

. Basics of ecology, ecosystems and sustainable development.

. Conservation of land forms and preservation of species

. Pollution of air, water, soil, food and food products

  - causes
  - effects
  - monitoring and control

. Sources of energy, advantages of non-conventional energy sources and low path energy methods.

. Conservation of energy including redesign of plant, machinery and processes

. Industrial pollution

. Measures for afforestation and arresting soil erosion

. Prevention of advancement of deserts and lowering of water table.

DIPLOMA IN ELECTRICAL ENGINEERING
STAFF STRUCTURE

	Intake of the course	30
	Pattern of the course	3yrs
1.	Principal	1
2.	H.O.D.	1
3.	Lecturer Elect. Engg.	3
4.	Lecturer Electronics Engg.	1
5.	Lecturer Maths	1 | Part time or
6.	Lecturer Physics	1 | common with
7.	Lecturer Chemistry	1 | other discipline
8.	Lecturer Language	1 | if the intake is more than 180.
9.	Lecturer Computer	1
10.	Steno typist	1
11.	Accountant/Cashier	1
12.	Student/Library Clerk	1
13.	Store Keeper	1
14.	Class IV	6
15.	Sweeper	Part time as per requirement.

The posts of Choukidar and Mali will be sanctioned according to the justification of institution. Services for existing staff in other disciplines of the institute may be utilised if possible.

The posts at serial number 4,5,6,7,8,9,10 and 11 are minimum common staff in the institute.

Staff qualifications will be as given in the service rules.

Staff development for teaching industrial management and entrepreneurship development may be done by the institute.

Guest lectures may be organised at suitable time.

SPACE REQUIREMENT

		No	M2
A.	Total Land Area		
B.	Administrative Block		
1.	Prinicipal's room	1	30
2.	Steno room	1	6
3.	Confidential room	1	10
4.	Office room	1	80
5.	Library (common with other disciplines)	1	150
6.	Common room	1	80
7.	Class rooms	2	150
8.	Store	1	100
9.	Model room	1	90
C.	Laboratories/Workshops		
1.	Drawing Hall @ 8 sq.m. per student	1	120
2.	Basic Elect. Engg./Measurement lab @ 5 Sq.m. per student	1	75
3.	Electrical M/c lab. @ 8 Sq.m. per student control.	1	120
4.	Electrical maintenance & repair lab @ 8 Sq. m. per student.	1	120
5.	Electronics lab @ 5 Sq.M. per student	1	75
6.	Computer room	1	60

Note: Labs of physics, chemistry and coupuler science will be common for all dicciplines in the institale. Additional electronics lab will be needed in the institutions where electronics course is not running. However it will be more convinient and economical to run electrical Engg. and electronics engineering diploma courses in the same institution.

D.	Common Facilities		
1.	Dispensary	1	40
2.	Canteen & tuck shop	1	50
3.	Parking space/cycle stand	1	200% student
	with garrage		50% student
4.	N.C.C. block	1	70
5.	Guest room	1	30
E.	Residential Facilities		
1.	Hostel for students	1	for 40% student
2.	Staff quarters		
	Principal	1	Type IV
	HOD/Warden	2	Type IV
	Sr. Lect./Lect.	2	Type IV
	Technical/Ministerial staff	2	Type II
	Class IV	6	Type I
3.	Play ground (common)	1	_____

LIST OF EQUIPMENTS

Only those of the equipments given below which are essentially required for the conduction of practicals mentioned in the curriculum are to be procured by the institutions.

"Machine/Equipments/Instruments of old BTE list which are not included below are to be retained in the Lab/Shop for Demonstration purpose but not to be demanded fresh for purchase."

NOTE : Equipment for different shop and lab of latest verson should be purchased.

I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lenses of focal length 10 cm.,20 cm., 50 cm.and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lens holders	2	500	1000
7.	Anstronomical telescope	1	500	500
8.	Searl's conductivity apparatus with copper & steel rods 25 X 4 cm. diameter with all accessaries	1 set	1000	1000
9.	Lee's conductivity app. complete with all accessaries	1 set	1000	1000
10.	Constant water flow arrangement	2	400	800
11.	Boiler made of copper 2 lt. cap.	4	200	800
12.	Platinum resistance thermometer	2	800	1600
13.	Potentiometer - 10 wires with jockey	1	500	500
14.	Meter bridge complete	1	250	250
15.	Lead accumulator 2.2 V. and 20 amp. hour capacity	2	250	500
16.	Moving coil galvenometer	3	200	600
17.	Moving coil ammeter 0-1 amp., 0-5 amp., 0-10 amp., 1 no of each	3	250	750
18.	Moving coil voltmeter 0-1 V. 0-5 V., 0-10 V. 1 No of each	3	250	750
19.	Lechlanchi cell complete	3	100	300
20.	Resonance col. of steel tube with tuning forks and other accessaries	1	500	500
21.	Tuning forks set of different frequencies	1 set	1000	1000
22.	App. for determining coefficient of friction on a horrizontal plane	1 set	1000	1000
23.	Appratus for determining character-stics of P-N junction diode complete with all accessaries	1 set	1500	1500

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
24.	Post office box dial type	1	1200	1200
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600
26.	Rheostat of different ohm.capacity	8	250	2000
27.	Physical balance with weight box	2	800	1600
28.	Set of fractional weights	10	20	200
29.	Fortin's barometer with mercury	1	2500	2500
30.	Battery eleminator 6 V. & 3 amp.	1	250	250
31.	Lab tables	3	8000	24000
32.	Lab stools	10	100	1000
33.	Anemometer cup type	1	1000	1000
34.	Anemometer hand held	1	1000	1000
35.	Suryamapi	1	1500	1500
36.	Insolation meter	1	1500	1500
	Misc.	LS		5000

II. APPLIED CHEMISTRY LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Test tube stand	15	10	150
2.	Funnel stand	15	10	150
3.	Burette stand	15	30	450
4.	Pipette stand	15	10	150
5.	Chemical balances with analytical weights 1gm -200gms	5	1500	7500
6.	Fractional weights set with rider	5sets	25	125
7.	Kipp's apparatus 1000 ml. polythen	2	500	1000
8.	Reagents bottles			
	250ml	120	10	1200
	500ml	5	15	75
	1000ml	5	25	125
9.	Wide mouth bottle 250 ml	15	15	225
10.	Winchester bottle 2.5 litre	15	30	450
11.	Test tubes 1/4" x 6"	75	1	75
12.	Boiling tube 1" x 6" hard glass	24	10	240
13.	Pestle and morter 10 cms	2	30	60
14.	Watch glass 7.5 cms	15	5	75
15	Beakers			
	100 ml.	10	15	150
	250 ml.	24	20	480
	400 ml.	12	25	300
	1000 ml.	5	30	150
16.	Weighing bottle 10 ml with lid	15	10	150
17.	Wash bottles	15	15	225
18.	Conical flask 250 ml.	15	30	450
19.	Flat bottom flask 500 ml.	6	40	240
20.	Flat bottom flask 250 ml.	15	25	375
21.	Burette 50 ml.	15	60	900
22.	Pipette 25 ml.	15	20	300
23.	Measuring flask 250 ml. with stopper	15	50	750

24. Measring cylinder of various sizes (250 ml, 500 ml, 1000 ml) 3 no. of each	9	LS		250
25. Bunsen's burner of brass	15		50	750
26. Gas plant petrol 10 to 20 burners automatic	1		5000	5000
27. Spirit lamp	15		30	450
28. Tripod stand	15		10	150
29. Wire gauge 15 X 15 cm. with asbestos	15		15	225
30. Test tube holder	15		10	150
31. Porcelain plates	15		20	300
32. Funnel 15 cm.	15		16	240
33. Blow pipe & work tools with electric blower for glass blowing	1	set	10000	10000
34. Cork borers with sharpn	2	set	100	200
35. Cork pressure	1	set	250	250
36. Glass cutting knife	1		75	75
37. Spatula hard & nickel/steel	2	each	50	100
38. Water tapes with gooseneek	6		200	1200
39. Gas taps two way	10		150	1500
40. Pinch cock & screw	15		20	300
41. Distilled water units (electrical)	1		5000	5000

S.No.Name of Equipment	No.	@ Rs.	Amt.in Rs.
42. Distilled water units (solar)	1	5000	5000
43. Open balance 1000 gms./10 mg.	1	600	600
44. Platinium wire	5	25	125
45. Brush for cleaning various type	40	10	400
46. Jars 20 Lit. for keeping destilled water	5	100	500
47. Lab table 2 m. x 1.2 m. x 1 m. hight with central sink and cup boards (Teak wood) with drawers and two built in almirah on each side with reagent racks, better tile top	4	8000	32000
48. Exhaust fans 18"	4	2000	8000
49. Side racks and selves for bench reagents made of teak wood for 24 bottels each set	4	2000	8000
50. Digital balance electronic	1	10000	10000
51. Hot plates 7-1/2", 3" dia controled 2000 watts	1	1000	1000
52. Hot air oven thermostatically controled with selves and rotary switches 350 x 350 x 25 high	1	8000	8000
53 pH Meter	1	1000	1000
54 Glass Electrode	2		
55. Reference Electro	2		
Miscellaneous	LS		10000

III. WORKSHOP PRACTICE

CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	60 cm.rule	10	15	150
2.	Flexible steel rule 2 metre	2	20	40
3.	T square 23 cm. steel	10	20	200
4.	Bevel square 23 cm. steel	2	30	60
5.	Marking knife 25 cm. steel	10	30	300
6.	Marking gauge wooden & brass 25 cm.	10	30	300
7.	Mortise gauge wooden & brass 25 cm.	10	50	500
8.	Caliper inside,steel 20 cm.	2	50	100
9.	Caliper outside , steel 20 cm.	2	50	100
10.	Compass steel 20cm.	2	40	80
11.	Devider steel 20 cm.	2	40	80
12.	Plumb	2	20	40
13.	Wooden bench vice steel 20 cm.	10	200	2000
14.	Bench hold fast steel 30 cm.	10	40	400
15.	Bar clamp 2 m.	2	300	600
16.	G clamp of flat spring steel 20x30 cm.	4	60	240
17.	Rip saw 40-45 cm.	10	80	800
18.	Cross cut saw 40-45 cm.	2	80	160
19.	Tennon saw 30-35 cm.	10	50	500
20.	Dovetail saw 30-35 cm.	2	60	120
21.	Compass saw 35 cm.	4	60	240
22.	Key hole saw or pad saw 30-35 cm.	2	25	50
23.	Bow saw	2	25	50
24.	Frame saw	2	25	50
25.	Chisel fish brand 1" to 1/8"			
	firmer	3 set	100	300
	Dovetail	3 set	100	300
	Mortise	3 set	100	300
26.	Gauge or Golchi 1" to 1/8"	3 set	150	450
27.	Wooden jack plane complete	10	100	1000
28.	Wooden smoothing plane	10	80	800
29.	Iron jack plane complete	10	200	2000
30.	Iron rebate plane complete	3	80	240
31.	Iron grooving plane complete	3	120	360
32.	Iron compass plane complete	3	200	600
33.	Wooden moulding plane complete	3	200	600
34.	Bradawl	3	150	450
35.	Gimlet drills set	1 set	150	150
36.	Center bit	2	120	240
37.	Twist bit	2	80	160
38.	Auger bit	2	40	80
39.	Dovetail bit	2	15	30
40.	Counter shank bit	2	20	40
41.	Ratchet brace machine	2	175	350
42.	Grand drill machine 1/4"	2	200	400
43.	Wooden hand drill burmi	5	200	1000
44.	Wooden mallet	10	25	250
45.	Claw hammer	3	30	90
46.	Carpenters hammer	10	30	300

47.	Cutting tool for Universal wood working machine	3 set	800	2400
48.	Screw driver 18" & 15"	6	50	300

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
49.	Adze 500 gm.	10	50	500
50.	Pincer 175 mm.	6	75	750
51.	Plier 150 mm.	4	90	360
52.	Oil stone 8"	4	75	300
53.	Rasp file 12"	4	100	400
54.	Half round file 12"	4	80	320
55.	Round file 12"	4	80	320
56.	Triangular file 5", 4"	8	60	480
57.	Water stone	4	20	80
58.	Carpentry work benches	4	2000	8000
59.	Band saw machine complete	1	30000	30000
60.	Circular saw machine	1	15000	15000
61.	Double Ended Electric Bench grinder	1	6000	6000
62.	Universal wood working machine	1	15000	15000
	misc. for foundation of machines	LS		10000
	SMITHY SHOP			
1.	Anvil 150 Kg. with stand	5	2500	12500
2.	Swage block 50x30x8cm.&45x45x10cm.	2	1250	2500
3.	Hammers			
	Ball peen 0.8 Kg. (Approx.)	10	150	1500
	Cross peen 0.8 Kg. (Approx.)	10	150	1500
4.	Beak iron 25 Kg.	1	500	500
5.	Swages different types	6	40	240
6.	Fullers different types	6	30	180
7.	Leg vice 15 cms. opening	1	150	150
8.	Electric blower with motor	1	5000	5000
9.	Furnace chmney with exhaust pipe	5	5000	25000
10.	Sledge hammer - 5 Kg.	2	200	400
	Misc. tools		LS	2500
	SHEET METAL, SOLDERING & BRAZING			
1.	Dividers - 15cm.	5	60	300
2.	Trammel 1 m.	1		
3.	Angle protector	5	60	300
4.	Try square 30 cm.	5	40	200
5.	Centre punch	5	20	100
6.	Steel rule 30 cm. , 60 cm.,	5	25	125
7.	Sheet metal gauge	1	120	120
8.	Straight snips 30 cm.	2	250	500
9.	Curved snips 30 cm.	2	300	600
10.	Bench shear cutter 40 cm.	1	5000	5000
11.	Chisel 10 cm.	5	100	500
12.	Hammer	5	150	750
13.	Bench vice 13 cm.	5	1000	5000
14.	Plier	5	50	250
15.	Nose plier	5	60	300

16.	Sheet metal anvil/stakes	5	2000	10000
17.	Shearing machine 120 cm.	1	2500	2500
18.	Solder electric	2	500	1000
19.	Solder furnace type	2	250	500
20.	Brazing equipments and accessories	1	5000	5000
21.	Blow lamp	2	250	500
22.	Sheet bending machine	1	10000	10000
	Misc.		LS	5000

FITTING SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Bench vice jaw 10 cm.	10	300	3600
2.	Surface plate 45x45 cm.	2	2000	4000
3.	V. Block 10x7x4 cm.	5	350	1650
4.	Try square	10	40	400
5.	Bevel protractor 30 cm.	1	2100	2100
6.	Combination set	1	2500	2500
7.	Divider	5	60	300
8.	Centre punch	5	20	100
9.	Calipers (Different sizes)	12	20	240
10.	Vernier calipers 30 cm.	2	600	1200
11.	Micrometer 0-25, 25-50 m.m.	4	500	2000
12.	Vernier depth gauge	1	350	350
13.	Feeler gauge--15 blades	1	30	30
14.	Radius gauge	1	100	100
15.	Angle gauge	1	100	100
16.	Thread gauge	1	100	100
17.	Bench drilling machine 13 mm.	1	5000	5000
18.	Double ended electric grinder	1	4000	4000
19.	Drill set	1set	1000	1000
20.	Reamer set	1set	2000	2000
21.	Tap set	1set	2000	2000
22.	Adjustable wrenches (15 cm.,20cm. 30 cm.)	1set	500	500
23.	Allen key set	1set	350	350
24.	Spanners	6	60	360
25.	Work benches	6	2000	12000
26.	Power hacksaw	1	4000	4000
	Misc. Files, Dieset, Hexa frames etc.		LS	10000

WELDING SHOP

1.	Ellectric welding set oil cooled	1	10000	10000
2.	Industrial regulator type oil cooled arc welder	1	12000	12000
3.	Air cooled spot welder 7.5 KVA	1	15000	15000
4.	General accssories for air cooled spot welder of 7.5 KVA			8000
5.	Gas welding set with gas cutting torch and complete with all accessories	1	15000	15000
6.	Misc. work benches		LS	20000

PAINTING & POLISHING SHOP

1.	Air compressor complete with 2 HP motor	1set	12000	12000
2.	Spray gun with hose pipe	1	1000	1000
3.	Stoving oven	1	3000	3000
4.	Buffing machine with leather and cotton wheels	1	4000	4000
5.	Electroplating Equipment for cromium Nikle plating.	1	10000	10000
	Misc.		LS	2000

PLUMBING SHOP

1.	Pipe vice 5 cm.	4	250	1000
2.	Chain wrenches	5	250	1250
3.	Ring spanner Set	5	125	625
4.	Wheel pipe cutter	2	300	600
5.	Water pump plier	4	50	200
6.	Pipe die set 2" set	2 set	600	1200
7.	Pipe bending device	1	5000	5000
8.	Work benches	4	4000	16000
9.	Set of various types of plumbing fittings e.g. Bib cock Cistern, Stop cock, Wheel volve, Gat volve etc.		LS	2000
10.	Misc. Hacksaw frame and others		LS	2000

FOUNDRY SHOP

1.	Moulding boxes	25		6000
2.	Laddles	5		1000
3.	Tool kits	10 sets		2500
4.	Quenching tanks water or oil	2		1000
5.	Permiability tester	1		1000
6.	Mould hardness tester	1		6000
7.	Sand tensile testing equipment	1		7500
8.	Portable grinders	1		3000
9.	Temperature recorders/controllers	LS		5000
10.	Pit furnace with Blower	1		5000

MACHINE SHOP

1.	Lathe machine 4.5 feet "V" bed. Height of centres 8.5 inch. Dog chuck 8 inch complete 1 H.P. motor 440v, push button starter with coolent pump,tray and with standard accessories.	2	25000	50000
2.	Shaper machine 12 inch stroke with 2 H.P. motor 440 volts push button starter with vice 6 inch (Swivel base)	1	20000	200000

NOTE:-

The institutes running mechanical engg. course need not purchase these two items sepreately because they will have one complete machine shop for the course

COMPUTER APPLICATION FOR ENGINEERING (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in Rs.)
1	PENTIUM-IV 2.4 Ghz or latest RAM-256 MB or latest HDD-80 GB latest MONITOR COLOUR 17" AGP 16 MB 52X MM KIT(52x CD Drive, Speaker,sound card) FDD - 1.44 MB Key Board - 107 Keys Multimedia Mouse - Optical Fibre Mouse 32 Bit PCI ETHERNET CARD(10/100) Mbps Pre loaded Windows XP OR WINDOWS 2000 Pre loaded Norton Anti Virus with licence media and manual OR Computer of latest Specification	16 (15+1Server)	8,000,00=00
Software :			
i.	Noval Netware/NT Latest Version	01	55000
ii	WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
iii.	MS OFFICE XP	01	17000
iv.	Dos latest version.	01	5,000
v.	FoxPro 2.5 or Latest Version	01	
vi.*	Mechanical DeskTop Power Pack (*->Only For Mechanical Engg.)	01	70000
3. Hardware			
i.	Internal Modem 56 kbps		
ii.	Hubs-16 port, all accessories related to Networking.		
iii.	Scanner- A4	01	10,000
4.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	01	15,000
5.	Laser Jet	01	20,000
6.	5 KVA on line UPS with minimum 30 miniute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network connectivity.	01	1,75000
7.	Window Air Conditioner 1.5 tones capctity with ISI mark alongwith electronic voltage stablizer with over viltage and time delay circuit	04	30,000(EACH)
8.	Room preparation and furniture	LS	

BASIC ELECT. ENGG. & ELECTRICAL INSTRUNMENTS & MEASUREMENT LAB

Sl. No.	Equipment	Qty.	Price
1.	Ammeter -dynamometer type portable, moving coil, permanent magnet 150 mm uniform scale		
a.	Range 0 - 2.5 - 5 Amp.	2	1200
b.	Range 0 - 50 m A	1	500
c.	Range 0 - 500 mA	2	1000
2.	Ammeter - moving iron type Portable moving iron permanent magnet, 150 mm uniform scale		
a.	Range 0 - 5 Amp.	2	1000
b.	Range 0 - 10/20 Amp.	2	1000
c.	Range 0 - 500 mA/1000 mA	2	1000
3.	Voltmeter dynamometer type portable moving coil permanent magnet 150 mm uniform scale		
a.	Range 0 - 5/10 V	2	1000
b.	Range 0 - 15/30 V	1	1000
c.	Range 0 - 50 mv/100 mv	1	1000
d.	Range 0 - 125/500 V	1	1000
e.	Range 250/500 V		
4.	Digital multimeter 3.5 digit - display D.C. voltage 0 - 1000 V in 5 steps A.C. voltage 0 - 750 V in 5 steps Resistance 0 - 20 M ohm in 6 steps D.C. 0 - 10 A in 6 steps A.C. 0 - 10 A in 6 steps Power supply 9 V.	1	3000
5.	Analog multimeter (Portable) D.C. Voltage 0 0 1000 V AC Voltage 0 2/5/10/25/100/250/1100 V. Resistance 0 200 M ohm DC 0 - 50 micro Amp./1 mA/10 mA/100mA/1A/10A AC 0 - 100 mA/1A/25 A/10A	1	1000
6.	Wattmeter single phase (LPF= 0.2) portable dynamometer type, scale 150 mm current range 0 - 5/10 Amps voltage Range 0 - 250/500 V	2	5000
7.	Decade resistance box constantan coils, single dial 10x10, 10x100, 10x1000, 10x10,000 ohms	1	1000
8.	Continuously variable 0 - 1000 micro farad, 250 V	1	1000
9.	Energymeter single phase	1	2000

	induction type, industrial grade 5 A or 10 A, 250 V, 50 Hz.		
10.	Energymeter(Substandard) single phase, induction type 5 A/10A, 250 V, 50 Hz.	1	3000
11.	Power factor meter dynamometer type, eddy current damping, 50 Hz, scale length 150 mm range upto 20 amp, voltage range 300 V 10 F. range 0.5 log, unity 0.5 load.	1	5000
12.	Frequency meter (Reed type) 230 V, range for having 21 reeds for 40-60 Hz range.	1	500
13.	Rheostat sliding rheostats wound with evenly oxidised iron free nickel copper on vitreous enamelled round steel tube 150 ohms 2 Amps. 110 ohms 2.5 Amps.	1 1	600 600
14.	Variable inductor single phase, 250 V, 2.5 KVAr continuously variable	1	2000
15.	Cathode ray oscilloscope 10 MHz dual beam oscilloscope vertical defeection band width DC-10 MHz (-3db) rise time 30 ms defeection coefficient 12 horizontal defeection band width 1 MHz (+6db)	1	10,000
16.	Battery charger 12 V silicon bridge rectifier AC input 230 V, DC output suitable for charging 6 V And 12 V batteries provided with MC voltmeter 0 - 20 V and ammeter 0 - 5 A	1	1000
17.	Capacitors 2.5 microfarod, electrolytic type	4	200
18.	Q Meter frequency 0 - 30 MHz Q 0 to 500	1	4000
19.	LCR meter (digital) 3.5 digit display capacitance 0 to 20,000 microfarad inductance 0 to 200 Henry resistance 0 to 20 M ohms	1	8000

20.	LCR/Q bridge capable of measuring resistance, inductance and capacitance of range 8 amps, 0.012 to 10 M ohms, 4 to 10,000 H, 0.5 pico farad to 10 F.	1	5000
21.	Kelvin double bridge 10 x 0.1 ohms circular slide wire devided into 200 equal parts		
22.	Energy meter 3 phase induction type, 4 wire, industrial grade, 50 Hz, 10 A, 440 Volt	1	5000
24.	Energy meter (Sub standard) 3 phase, 4 wire, 440 V, 10A, 50 Hz induction type.		
25.	Transformer single phase core type, 230/110 V, 1 KVA, 50 Hz.	1	5000
26.	Universal shunt 0 - 75 A	1	2000
27.	Current transformer 10/25/50/5A as per IS 4201/1967 and 2705/1981	1	2000
28.	Potential transformer 10 VA, 415/110 V as per IS 4201/1967 and 2705/1981	1	2000
29.	Strain guage	1	1000
30.	Maxwells bridge	1	1000
31.	Weins bridge	1	1000
32.	Schering bridge	1	1000
33.	Single Phase AC Watt Hour Meter (Electronic Energy Meter) 240V,50 C/s 10 Amp.,	1	1200
34.	3 Phase Four Wire (3X240V between Line To Nuetral) AC static Watt Hour Meter (Electronic Energy Meter) 10A	1	2500
35.	Trivector Meter	1	5000

ELECTRICAL WIRING & FABRICATION SHOP

1.	Portable drilling machine drilling 10 mm no load speed 700 rpm 435 W capacity supply voltage 230 V, 50 Hz	2	9600
2.	Meggar having hand driven generator to generate 500 V d.c. range of measuring insulation resistance from 0 - 100 M ohms IS 2992/1965	1	1500
3.	Murcury vapour lamp M.L. Type, 125 W, 230 V, 50 Hz	1	150
4.	Murcury vapour lamp 125 W, 230 V, 50 Hz, AC supply complete with choke, lamp holder and power factor capacitor	2	1000
5.	Sodium vapour lamp 12 W/250W, 230 V, 50 Hz. with choke	1	4000
6.	Fluorescent tube 230V, 50 Hz, 1 phase with choke and starter, various sizes and types 20 - 40 W	10	1250
7.	Screw driver set insulated handle with following blade sizes a. 2.5 x 10 mm b. 3.0 x 80 mm c. 4.0 x 120 mm d. 5.0 x 160 mm e. 5.0 x 200 mm	6	3600
8.	Combination plier 205 mm length with thick plastic insulated handle	12	4800
9.	Long nose plier 150 mm length, insulated for 500 V	6	1500
10.	Diagonal plier 150 mm length insulated for 500 V suitable for cutting hard wires	6	1500
11.	Adjustable wrench 205 mm chromium plated adjustable wrench lengths from 25 mm to 30 mm	6	1800
12.	Flat nose plier	3	900

	plastic insulated handles length 130 mm		
13.	Ball pean hammer wooden handle wts. 500 gms.	6	90
14.	Adjustable hacksaw frame tubular steel frame, adjustable for hacksaw blade from 250 - 300 mm with set of 10 spare blades	4	1200
15.	Hand drill machine two speed with self centering chuck for straight shank drills upto 10 mm.	2	2000
16.	Bench vice jaw width 100 ,, jaw opening 120 mm, jaw depth 75 mm.	2	1600
17.	Wire gauage to measure gauages of wires in MKS system	1	200
18.	Measuring tape pocket measuring tape of steel spring return device. flexible graduated in metric readings, 2 meter long.	6	1200
19.	File set hand files with plastic handle 200/350 mm long a. Flat smooth cut b. Flat second cut c. Half round d. Half round second cut e. Round smooth cut f. Triangular file 200 mm	1	1000
20.	Screw driver mains voltage tester suitable upto 400 V overall length 180 mm.	2	400
21.	Cable kinfe plastic handle 50 mm overall length 180 mm.	6	600
22.	Rubber mallet wooden handle with wt. 200 gms	6	900
23.	Hand saw hand saw 10" size 10 teeth per inch with teak wood handle	6	1800
24.	Bench steel construction with wooden bench top not less than 50 mm thick with two steel drawers	1	1500

	both lockable. Approx size 1200 x 600 x 850 mm		
25.	Electrical fittings	L.S./yr.1000	
26.	MCB 6A, 16A, 32A,250V	150 Each	
27.	Earth Line Circuit Braker (ELCB) 15 A.	300	

ELECTRICAL MACHINE LAB

1.	Laboratory D.C. power supply (220 V) static converter input from 3 phase 50 Hz, 415 volts A.C., output rating of 200 vatts to 260 watts, 50 amps, continuously varibale.	1	50,000
2.	Diesel generator set 3 phase, 415 volts, 15 kva, 50 Hz, diesel generator set, with suitable control pannel, for a stabilized supply including metering for voltage, current frequency, fuel level storage fuel tank of 200 litre capacity 12/24 volt battery for starting the engine, battery charger mounted on trolley wheels.	1	10,00,000
3.	D.C. motor generator set two identical 220 V, 1 KW 1500 rpm. compound d.c. machines with all terminals of armature, series field, shunt field separately mounted for independent connections. D.C. motor starter, field control rheostat suitable for above machines. brushes, commutator should he vissible for study purposes.	1	15,000
4.	D.C. shunt motor 220 V, 3 KW, 1500 rpm dc shunt motor with 3 point starter and ponybrake loading arrangement with loading drum, spring balance with belt.	1	10,000
5.	D.C. series motor 220 V, 3 KW, 1450 rpm dc series motor with drum controller starter and pony brake loading arrangement with loading drum spring balance with belt.	1	10,000
6.	Compound motor 220 V, 3 KW, dc 1500 rpm compound	1	10,000

	motor with 4 point starter and pony brake loading arrangement with loading drum, spring balance with belt.		
7.	Single phase transformer 1 KVA, 50 Hz, Pr 230 V with a tapping at 50% and 86.6% secondary - 230 V with tappings at 50% and 86.6%		
8.	3 Phase variable inductive loading unit rating 400 V, 50 Hz, 0-10 Amps.	1	8000
9.	3 Phase variable capacitive loading unit: rating 400V, 50 Hz, 0-10 Amps.	1	5000
10.	3 Phase squirrel cage induction motor rating 415 V, 50 Hz, 1440 rpm 3 KW with star/Delta starter	1	1,2000
11.	Starters for squirrel cage induction motor suitable for 3KW, 415V, 50 HZ, 1440 rpm		
	a. Star/delta automatic	1	5000
	b. Star/delta manual	1	3000
12.	Starter for squirrel cage induction motor 3KW, 415 V, 50 Hz, 1440 rpm direct on line	1	3000
13.	Starter for slip ring induction motor 3 KW, 415 V, 50 HZ, 1440 rpm auto transformer starter with automatic protection for over loading and single phasing.	1	5000
14.	Static speed control unit for 3 phase induction motor 3 KW, 425, 0-1500 rpm.	1	5000
15.	3 Phase alternator coupled to d.c. compound motor 3 phase 415 V, 50 Hz, 1500 rpm, 3 KVA star connected alternator, field excitation 110 V dc with field regulator prime mover d.c. compound wound motor, 220 V, 3.5 KW, 1500 rpm with starter and shunt field regulator	2	50,000
16.	3 Phase synchronous motor (induction start) rating 3 KW, 3 phase, 1500 rpm, 50 Hz 415 v A.C. supply with d.c. exciter mounted on the shaft of motor with suitable starter.	1	15,000
17.	Capacitor start single phase induction motor 230 V, 50 Hz	1	2500

	1440 rpm, 500 watts.		
18.	Repulsion induction motor 230 V, 50 Hz, 1440 rpm, 500 W	1	2500
19.	Universal motor 230 V, 50 Hz, 1440 rpm, 500 w.	1	2500
20.	Shaded pale induction motor 230 V, 50 Hz, 1440 rpm, 500 W	1	2000
21.	Analog multimeter moving coil, input impedence 1 M ohm per volt, frequency 40-400 Hz, d.c. voltage 30 mv - 1000 V a.c. voltage 100 mv - 1000 V, ac and dc current 10mA - 10 A resistance 0 - 10 M Ohms with power supply battery and connecting leads.	1	1000
22.	Clipon ammeter/voltmeter measuring ranges current 0 - 12 - 50 A voltage 0 - 500 V	2	4000
23.	Clipon watt meter for measurement of active and reactive power with ranges current 10/30 A voltage 30/150/1500 V power 1 Kw	1	3000
24.	Clip on power factor meter measuring ranges capacitive 0.5 - 1.0 inductive 0.5 - 1.0 rated voltage 100/200/400 V rated current 5 A - 25 A		
25.	Moving iron ammeter-portable scale length 150 mm range		
	a. 0 - 2.5 - 5 A	2	2000
	b. 0 - 5 - 10 A	2	2000
	c. 0 - 10 - 20 A	2	2000
26.	Moving coil ammeter portable scale length 150 mm range		
	0 - 1 - 2 A	2	2000
	0 - 2.5 - 5 A	2	2000
	0 - 5 - 10 A	2	2000
	0 - 10 - 20 A	2	2000
27.	Moving iron volt meter portable		
	a. 0 - 10 V	1	1000
	b. 0 - 15 V - 30 V	1	1000
	c. 0 - 75 V - 150 V	1	1000
	d. 0 - 150 - 300 V	2	2000

	e. 0 - 300 - 600 V	2	2000
28.	D.C. moving coil voltmeter - portable		
	a. 0 - 5 - 10 V	1	1000
	b. 0 - 15 -30 V	1	1000
	c. 0 - 75 -150V	1	1000
	d. 0 - 150-300V	2	2000
	e. 0 - 300-600V	2	2000
29.	Wattmeter single phase dynamometer type portable suitable for 45-55 Hz range		
	a. 75/300/600 V 2.5/5 A	2	5000
	b. 75/150/300 V 5.0/10 A	2	5000
	c. 150/300/600 V 15/30 A	2	5000
	d. 0 -150 - 300 V 0 - 2.5/5 A	2	4000
30.	Watt meter 3 phase induction type 2 element voltage range 0/300/600 V current range 0/5/10 A	1	2000
31.	Frequency meter - portable (pointer type) 45-55 Hz	1	2000
32.	Frequency meter - portable (Reed type) 45-55 Hz with 21 reeds	1	2000
33.	Frequency meter digital portable 3.5 digit LED display range 20-99 Hz	1	2000
34.	Phase sequence indicator (Rotary) 3 phase, 415 V, 50 Hz	1	1000
35.	Phase sequence indicator (Indicating type) 3 phase, 400 V, 50 Hz	1	1000
36.	Galvanometer centre zero response time 1.8 sec.	1	1000
37.	Power factor meter - single phase low current portable 0.5 capacitive to 0.5 inductive current - 20 amps voltage - 250 V frequency - 50 Hz	1	2000
38.	P.F. meter - single phase portable range 0.1 capacitive to 0.1 inductive current 2.5 amps voltage 230 V frequency 50 Hz	1	2000
39.	Power factor meter 3 phase range 0.5 capacitive to 0.5 inductive current - 10 amps, Voltage 414 V, 50 Hz	1	2000

40.	VAR meter 1/5 A, 300/600 V	1	2000
41.	Synchroscope - portable 230 V, 50 Hz	1	3000
42.	Loading rheostat single phase a. 240 V, 2.5 KW, trolly type resistance type b. 240 V, 6 KW insteps of 0.25	1 1	3000 3000
43.	Lamp load 3 phase 415 V, 6 KW	1	2000
44.	Water load 3 phase 415 V, 5 KW	1	2000
45.	Variable inductive load 415 V, 0-10 A, 50 Hz	1	6000
46.	Capacitor bank 415 V, 0-10 A, 50 Hz trolley mounted	1	3000
47.	Wire wound rheostats 15 ohms, 10 A 100 ohms, 5 A 250 ohms, 5 A 1000 ohms, 0.5 A 2500 ohms, 0.1 A	 2 2 2 2 2	 1200 1200 1200 1200 1200
48.	Stop watch least count 0.01 Sec.	2	2000
49.	Stop watch (digital) LED	2	2000
50.	Single Phase Induction Motor 1/2 HP,230V 50 Cyl., 1400 RPM	2	3000
51.	3 Phase Slip ring type induction motor (Wound Rotor Type), 440V, 50 C/S,5 HP with manually operated variable rotor resistance starter,suitable star connector varable resister	1 set	20000
52.	Break drum loading arrangement suitable for 5 HP motor with spring balance, belt fitted on iron frame, etc, complete with pannel board consisting amp. meter(MI) 10A, Voltmeter(MI) 600V and suitable TPICNL switch .	1	10000

INSTALLATION, MAINTENANCE & REPAIR OF ELECTRICAL MACHINES LAB

1.	Earth tester (Portable) 500 V, 0 - 10 - 100 ohms, complete with all assessaries, (hammer, screw driver, 3 spikes) housed in a teak wood/abonite case	1	2000
2.	Transformer oil testing kit	1	10,000
3.	Coil winding machine bench mounted, power driven with clutch and brake, electro- magnetic traverse clutch system. Max. winding speed 250 to 5500 rpm.	1	16,000
4.	Portable drilling machine drilling 10 mm, no load speed 700 rpm, 435 W, 230 V, 50 Hz.	1	4500
5.	Multimeter ac/dc 0 to 600 V ac 50 mA to 10 A dc 10 mA to 10 A ohm meter 2 ohm - 20 K ohm	1	1200
6.	Meggar having hand driven generator 500 V, resistance 0 - 100 M ohms.	1	1500
7.	Ceiling fan 230 V, 1 phase, 50 Hz.	1	700
8.	Table fan 230 V, 1 phase, 50 Hz	1	600
9.	Exhaust fan 375 mm sweep, 230 V, 50 Hz	1	1500
10.	Desert cooler 375 mm sweep, 1400 rpm, 1/4 HP 230 V, 50 Hz.	1	4000
11.	Electric kettle 750 W, 230 V, 50 Hz	1	400
12.	Electric iron (Automatic) 500 W, 230 V, 50 Hz	1	500
13.	Electric toaster 500 W,230 V,50 Hz.	1	500
14.	Geyser 10 Lit. capacity, 2 Kw, 230 V, 50 Hz	1	2000
15.	Immersion rod 1000 W,230 V, 50 Hz.	1	100

16.	Room heater 1000 W, 230 V, 50 Hz.	1	200
17.	Room heater (rod type)	1	200
18.	Air convector 2000 W, 230 V, 50 Hz	1	600
19.	Mixer cum grinder 250 W, 230 V, 50 Hz	1	1500
20.	Hot plate 1500/2000 W. 230 V, 50 Hz	1	500
21.	Electric oven 2 KW, 230 V, 50 Hz	1	600
22.	Washing machine 230 V, 50 Hz, 20 Lit. capactiy	1	3000
23.	Electric shaver 40-60 W, 230 V, 50 Hz	1	400
24.	Electric lighter	1	40
25.	Armature growler	1	2000
26.	Electric blower	1	1000
27.	Miniature circuit breaker	1	500
28.	Emergency light 55 cm long with 6 V battery	1	2500
29.	Voltage stabilizers 500 VA, input 172/260 V output 210/240 V automatic	1	2000
30.	Screw driver set	6	3600
31.	Combination plier	6	2400
32.	Long nose plier	6	2400
33.	Adjustable wrench	3	900
34.	Flat nose plier	3	900
35.	Slip nose plier	3	900
36.	Round nose plier	3	900
37.	Ball pean hammer		
	wt. 250 gms	3	50
	500 gms	3	50
	800 gms	3	50
38.	Spring holding screw driver set		

	4 x 50 mm	2	50
	4 x 75 mm	2	50
	4 x 100mm	2	50
39.	Hand drill machine	1	1000
40.	Bench vice with 100 mm jaw opening	2	1600
41.	Bearing Puller 100/200 mm.	2	200
42.	Files set a. Flat smooth cut b. Flat second cut c. Half round d. Half round smooth cut e. Round second cut f. Round smooth cut g. Square second cut h. Square smooth cut i. Triangular cut	1	1000
43.	Screw driver mains voltage tester	2	200
44.	Cable knife	6	600
45.	Soldering gun kit	1	200
46.	Rubber mallet	3	450
47.	Letter stamp set	1	200
48.	Box spanner set	1	800
49.	Open ended spanner set	1	800
50.	Blow lamp	1	400
51.	Wrench set	1	400
52.	Pipe wrench	1	500
53.	Electroplating equipment set 0 - 24 V, 0 - 100 A	1	25,000
54.	Battery charging equipment	1	2000
55.	Oil circuit breaker system voltage 33 KV highest system voltage 36 KV interupting capacity 500 KVA operating duty 0-3 min. breaking time 5 cycles continuous current rating 400 A.	1	10,000
56.	Air circuit breaker rating 600 A, 660 V, 50 Hz breaking capacity 35 KA, 40 KA		

57.	Differential relay 5 A, 50 Hz	1	12,000
58.	Buchholz relay	1	3000
59.	Cable testing and fault finding kit	1	20,000
60.	Cable joints and termination Kit	1	2500
61.	Distance relay	1	5000

ELECTRONICS LAB

(Electronics I, Electronics II & Industrial Electronics & Control, Industrial control, Microcessor Development System Lab)

1.	Audio oscillator	2	4000
2.	Multimeter (Analog)	2	2000
3.	Multimeter (Digital)	4	12000
4.	Regulated power supply 0-30V,.5/1A	4	8000
5.	Dual power supply 0-30V,1A	2	5000
6.	Power supply 0-300 V	2	4000
7.	C.R.O. (0-10 MHz)	2	20000
8.	Dual trace C.R.O.(0-10 MHz)	1	15000
9.	R.F. signal generator	1	5000
10.	A.C. milli voltmeter	2	4000
11.	Output audio power meter	1	1500
12.	A.C. milli ammeter/ A.C. micrometer & A.C. millivoltmeter (suitable range)	4	800
13.	D.C. voltmeter/milliammeter/micrometer (suitable range)	10	2000
14.	Decade resistance box	2	1200
15.	Component storage rack	5	25000
16	Consumable items	L.S.	20000
17.	Miscellaneous	L.S.	20000
18.	Logic probe	8	2400
20.	Logic board/trainer including bread board & flexible leads	2	7000
21.	Microprocessor trainer kit with 8085 & 8086 systems	1	20000
22.	Semiconductor data book	1	-
23.	Half wave & full wave rectifier kit	2	1000
24.	Bread board	10	1000
25.	Digital trainer kit	1	2500
26.	8085 Microprocessor kits with interfaces for- i) Stepper motor & Associated Supply ii) A/D & D/A iii) Digital I/O iv) With temperature Sensor v) With strain gauge Sensor	2	600
27.	ICs TTL,CMOS,Microprocessor & support chips	L.S.	10000
28.	Tool set	10	6000
29.	A.F. generator	1	3000
30.	Microcontroller 8051 trainer kit	1	8000
31.	D. C. Servomotor	1	1000

32.	Synchrosystem (pair)	1	5000

NOTE

1. Item no. 26 (iv) & (v) and Item 30 are required only for Microprocessor Development System lab only.
2. Item no. 31 and 32 are required for Industrial Electronics and Control lab & Industrial Control-I lab.

ELECTRICAL AND ELECTRONICS INSTRUMENTATION LAB

NOTE: Electrical and Electronic Instrumentation lab requires equipments and its erection, installation & maintenance which is costly hence it is suggested that practicals should be shown in the nearest process industry or educational institute having instrumentation & process control lab interaction and real life experience.

ELEMENTRY MECHANICAL & CIVIL ENGG LAB

1.	Diesel engine 5HP single cylinder,4 stroke,horizontal	1	10000
2.	Petrol engine 150cc single cylinder,2 stroke	1	10000
3.	Hand tachometer	2	1000
4.	Stop watch	2	1000
5.	Screw jack	1	500
6.	Apparatus for verification of Bernoullies theorem	1	8000
7.	Apparatus for determining friction loss in pipes and fittings	1	10000
8.	Cut section models of Pelton & Francis turbines.	1	30000
9.	Tensile testing machine	1	10000
10.	Motor generator set	1	30000
11.	Measuring chain 30m long IS 492	2	200
12.	Measuring chain 20m long IS 492	1	150
13.	Steel arrows	20	200
14.	Metallic tape 30/20m long	5	500
15.	Ranging rod of NS conduit	15	750
16.	Optical square	2	200
18.	Cross staff	2	200
19.	Line ranger	2	150
20.	Prismatic compass 100mm	1	500

21.	I.O.P. level 230mm with stand and other accessaries	2	3000
22.	Dumpy level 350mm with stand	2	2000
23.	Levelling staves 4m		
	a.Telescopic	1	250
	b.Folding	1	250
	c.Single length	4	600
24.	Miscellaneous for pegs,mallet steel bend etc.	L.S.	2000

INDUSTRIAL CONTROL LAB
(For Electrical Engg. (Industrial Control)

1.	D.C. Shunt Generator 1 KW, 220 V Coupled with 3 Phase Induction Motor of identical power	1 Set	5000
2.	D.C. Shunt Motor 1 KW, 220 V	1	3000
3.	Fully Controlled/Half Controlled Thyristor rectifier 600 V, 10A	1	1000
4	Thyristor Chopper 10A,600 V with T-on Control	1	1000
5.	Cyclo Convertor for 3:1 Frequency Conversion 600 V, 10A	1	1200
6.	SCR/Triac phase Controller, 600 V, 5A	1	100
7.	Star/Delta Starter,3 phase, 400 V, 5A	1	800
8.	Auto Transformer Starter, 3 phase 400 V, 10A	1	2000

LEARNING RESOURCE MATERIALS

1.	Overhead Projector with screen	1	--	20000
2.	35 m.m. Slide cum Film Projector	1	--	50000
3.	Audio Cassette Recorder	1	--	15000
4.	V.C.R. with Monitor & Accessories	1	--	35000
5.	Photography Camera for Production of slide and film strips, 35 mm still camera dark room equipment.	1		100000
6.	Mathematical Typewriter	1	--	50000
7.	Cutting, Binding & Stitching equipment.	1	--	30000

ANNEXURE - I

FIELD EXPOSURE

The second year students after annual exam. will have a four week hands on Industrial Training in any industrial unit engaged in manufacturing electrical machines/Electrical goods/Production and distribution of Electricty. They will work and focus their attention there on following points to incorporate them in their reports.

1. Name and Address of the unit
2. Date of

   i. joining.
   ii. Leaving
3. Nature of Industry

   i. Product.

   ii. Services

   iii. Working Hrs.

4. Sections of the unit visited and activities there in.
5. Details of machines/Tools & instruments used in working in the section of the unit visited.

   Work procedure in the section visited.

   Specification of the product of the section and materials used.

   Control of work & Quality.

   Inspection procedures packing storing and dispacting of products.

   Use of computer - if any

   Visit of units store, Manner of keeping store items, Their reciving and distribution.

   Safety measures on work place & working condition s in general comfortable, convenient and hygeinic. Pollution, professional deseases and hazards if any. Precautionary measures.

RECOMMENDED BOOKS

List of standard Text Books recommended for diploma level institutions of Uttar Pradesh

1. DISCIPLINE : APPLIED PHYSICS

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ANUPRAYUKT BHAUTKI	GUPTA & GUPTA	HINDI	1995	75.00	ASIAN PUBLISHERS, 85-C NAI MANDI, MUZAFFAR NAGAR
2.	ENGINEERING BHAUTKI	Dr. BHARGAVA	HINDI	1995	60.00	DHANPAT RAI & SONS
3.	ANUPRAYUKT BHAUTKI	KUMAR & TYAGI	HINDI	1995	75.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD,MEERUT
4.	ANUPRAYUKT BHAUTKI	Dr. R.C.PANDEY	HINDI	1994	75.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD, MEERUT
5.	APPLIED PHYSICS-I (Vol - I)	Dr. H.H.LAL	ENGLISH	1993	45.00	TATA McGRAW HILL
6.	APPLIED PHYSICS-II(Vol - II)	Dr. H.H.LAL	ENGLISH	1993	54.00	TATA McGRAW HILL
7.	MODERN COLLEGE PHYSICS	WHITE	ENGLISH	1995	110.00	C. B. S.
8.	PHYSICS Vol - I & II	HOLLIDAY AND RESNIC	ENGLISH	1993	100.00	WILEY EASTERN

1. DISCIPLINE : APPLIED MATHEMATICS

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	APPLIED MATHEMATICS (Math-I & Math-II)	KAPOOR & TARAMAN	HINDI	1994	75.00	NAV BHARAT PRAKASHAN, MEERUT
2.	APPLIED MATHEMATICS (Math-I & Math-II)	Dr KAILASH SINHA	HINDI	1994	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
3.	APPLIED MATHEMATICS (I & II)	LUTHERA	HINDI	1994	65.00	B. Tec. PRAKASHAN, LUCKNOW
4.	APPLIED MATHEMATICS (I & II)	P. GUPTA	HINDI	1994	65.00	ASIAN PUBLISHERS, MUZAFFAR NAGAR
5.	ADVANCE Engg. MATHS	H. K. DAS	ENGLISH	1994	125.00	S. CHAND & COo., RAM NAGAR NEW DELHI

1. DISCIPLINE : COMMUNICATION TECHNIQUES

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ENGLISH FOR COMMUNICATION	V. SHASHIKUMAR M. N. K. BOSE	ENGLISH	1987	21.00	I. R. D. T. U. P., KANPUR
2.	SAMPRESHAN TAKNIK	Prof. R. PAL Dr. Smt NEERAJ SHUKLA Dr.SUBHASH GARG	HINDI	1989	15.00	I. R. D. T. U. P., KANPUR

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and industrial legislation.

Sl.No. Units 1. DISCIPLINE : APPLIED CHEMISTRY

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ANUPRAYUKT RASAYAN	KHANNA & KHANNA & BOUNTRA	HINDI	1994	60.00	BHARAT BAARTI PRAKASHAN, MEERUT
2.	PRAYUKT RASAYAN	MAHENDRA AND SRIVASTAVA	HINDI	1994	58.00	B.TECH. PUBLISHERS,AMMINABAD LUCKNOW
3.	PRAYUKT RASAYAN SHASTRA	S. CHANDRA	HINDI	1994	60.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD,MEERUT
4.	APPLIED CHEMISTRY	V. P. MEHITA	HINDI	1993	60.00	ASIAN PUBLISHERS, 85-C NAI MANDI, MUZAFFAR NAGAR
5.	ENGINEERING RASAYAN	Dr. LALIT	HINDI	1994	45.00	DHANPAT RAI & SONS, 1682 NAI SARAK, DELHI
6.	ENGINEERING CHEMISTRY	P. C. JAIN	ENGLISH	1994	100.00	DHANPAT RAI & SONS, 1682 NAI SARAK, DELHI

1. DISCIPLINE : ELECTRICAL ENGINEERING

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	BASIC ELECTRICAL ENGINEERING					
	VOLUME-1	P. S. DHOGAL	ENGLISH	1994	70.00	TATA McGRAW HILL PUBLISHING
	VOLUME-2	P. S. DHOGAL	ENGLISH	1994	70.00	TATA McGRAW HILL PUBLISHING
2.	VEDUATE ENGINEERING -I	U. B. SINGH	HINDI	1993-94	65.00	B. TECH. PUBLISHERS
	VEDUATE ENGINEERING -II	U. B. SINGH	HINDI	1993-94	70.00	B. TECH. PUBLISHERS
3.	ELECT. ENGG. DESIGN DRAWING AND ESTIMATING	K. B. RAINA & S. K. BHATTA-CHARYA	ENGLISH	1991	55.00	WILLEY EASTERN
4.	ELECTRICAL TECHNOLOGY	B. L. THERAJA	ENGLISH	1990	150.00	S. CHAND & CO. N. DELHI
5.	ELECTRICAL ENGG. DRAWING DESIGN & ESTIMATING	JAGGI & PAL & LAL	HINDI	1994	85.00	NAV BHARAT PRAKASHAN MEERUT
6.	ELECTRICAL MACHINES	S. K. BHATTA-CHARYA	ENGLISH	1990	45.00	T. M. H. NEW DELHI
7.	A COURSE IN ELECTRICAL & ELECTRONICS MEASUREMENTS & INSTRUMENTATION	A. K. SAHNEY	ENGLISH		155.00	DHANPAT RAI & SONS
8.	ELECTRICAL INSTRUMENTS	T. D. BISHIT	HINDI	1994-95	60.00	ASIAN PB MUZZAFFAR NAGAR
9.	ELECTRICAL ENGINEERING MATERIAL	K. B. RAINA & S. K. BHATTACH-ARYA & T.JUNEJA	HINDI	1992	35.00	S. K. KATARIA & SONS
10.	GENERATION,DISTRIBUTAION AND UTILISATION OF ELECT. ENERGY	C. L. WADHWA	ENGLISH	1990	65.00	WILEY EASTERN
11 .	ELECT. ENGG. DESIGN DRAWING & ESTIMATING	T. D. BISHT	HINDI	LATEST	125.00	ASIAN PUB. MUZZAFFAR NAGAR
12.	GENERATION & UTILISATION OF ELECTRICAL POWER	Dr. M. H. RAI	HINDI	LATEST	125.00	DEEPAK PRAKASHAN KHULA SANTAN MORAR (M.P.)
13.	INDUSTRIAL ELECTRONICS	D. C. GUPTA	HINDI	LATEST	150.00	-DO-
14.	INSTRUMENTATION	KIRK & RIM RAI	ENGLISH	LATEST	120.00	D. B. TARAPOREBALA
15.	AUTOMATIC PROCESS CONTROL	D. ECKMEN	ENGLISH	LATEST	50.00	WILLEY-EASTERN
16.	INDUSTRIAL INSTRUMENTATION	D. ECKMEN	ENGLISH	LATEST		WILLEY EASTERN
17.	UTILIZATION OF ELECTRICAL ENERGY	SHRMA. K. NATH	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN MERUTT
18.	POWER PLANT ENERGY	B. L. HARZAI S. R. SINGH	HINDI	LATEST	60.00	B. TECH PUBLISHERS LUCKNOW -226018
19.	INSTALLATION, MAINTENANCE & TESTING OF ELECT. ENGG EQUIPMENT	BASANT KUMAR	HINDI	LATEST	80.00	NAV BHARAT PRAKASHAN MERUTT

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
20.	TRANSMISSION & DISTRIBUTION	K. B. RAINA	ENGLISH	LATEST	40.00	TATA Mc GRAWHILL NEW DELHI
21.	ELECTRICAL MACHINERY FUNDAMENTAL	S. J. CHAPMAN	ENGLISH	LATEST	80.00	-DO--
22.	ELECTRICAL ENGINEERING DRAWING DESIGN & ESTIMATING	S.K.BHATTACHA-RYA	ENGLISH	LATEST	70.00	WILEY EASTERN Ltd. NEW DELHI
23.	NON-CONVENTIONAL SOURCE OF ENERGY & APPROPRIATE TECHNOLOGY	AGRAWAL & BHATNAGAR	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN MERUTT
24.	ELECTRICAL POWER SYSTEM	C. L. WADHWA	ENGLISH	LATEST	100.00	WILEY EASTERN Ltd. NEW DELHI
25.	ELECTRICAL TECHNOLOGY -I	E. HUGES	ENGLISH	LATEST	55.00	8-2 PUBLICATION PVT. 13, DARYAGANG NEW DLHI
26.	ELECTRICAL TECHNOLOGY -II	E. HUGES	ENGLISH	LATEST	90.00	-DO-
27.	POWER ELECTRONICS	HARISH C. RAI	ENGLISH	LATEST	100.00	DHANPAT RAI & SONS
28.	SWITCH GEAR & PROTECTION	S. S. RAO	ENGLISH	LATEST	100.00	-DO---
29.	SWITCH GEAR & PROTECTION	M. V. DESH PANDEY	ENGLISH	LATEST	78.00	TATA Mc GRAW HILL
30.	POWER SYSTEM PROTECTION & SWITCHGEAR	B. RAVINDRANATH	ENGLISH	LATEST	35.00	WILLEY EASTERN Ltd.
31.	BASIC ELECTRICAL ENGINEERING	V. K. MEHTA	ENGLISH	LATEST	35.00	S. CHAND & COMPANY
32.	ELECTRICAL DESIGN & DRAWING	SURJEET SINGH	ENGLISH	LATEST	30.00	S.K.KATARIA & SONS NEW DELHI
33.	ELECTRICAL ENGINEERING DRAWING	S. K. BHATTAC-HARYA	ENGLISH	LATEST	99.00	WILLEY EASTERN Ltd.
34.	HAND BOOK OF ELECT MOTOR CONTROL SYSTEM	ESHWAR	ENGLISH	LATEST	99.00	TATA Mc GRAWHILL
35.	HAND BOOK OF ELECTRICITY	S. V. BHATIA	ENGLISH	LATEST	21.00	KHANNA PUBLISHERS
36.	ELECTRICAL ENGG. DESIGN & DRAWING	O. P. SONI	ENGLISH	LATEST	65.00	SATYA PRAKASHAN DELHI
37.	A COURSE IN ELECTRICAL MACHINES DESIGN	A. K. SAWHNEY	ENGLISH	LATEST	70.00	RAM NAGAR NEW DELHI DHANPAT RAI & SONS
38.	TESTING, COMMISIONNING OPERATION & MAINTENANCE OF ELECTRICAL & EQUIPMENT	S. S. RAO	ENGLISH	1987	70.00	KHANNA TECH. PUB. DELHI
39.	A TEXT BOOK OF LABORATORY COURSES IN ELECT ENGG.	KHARBANDA	ENGLISH	1990	50.00	S. CHAND & CO. DELHI
40.	A COURSE IN GENERAL ELECTRICAL DESIGN & DRAWING	SURJEET SINGH	ENGLISH	LATEST	85.00	KATSON PUBLISHING HOUSE NEW DELHI

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
41.	ELEMENTS OF ELECTRICAL POWER STATE ON DESIGN	M. V. DESH PANDEY	ENGLISH	LATEST	52.00	RAM NAGAR NEW DELHI A.H. WHEELERS & CO. ALLAHABAD
42.	GENERAL ELECTRICAL DRAWING	SURJEET SINGH	ENGLISH	LATEST	80.00	S. K. KATARIA & SONS LUDHIYANA
43.	ELECTRICAL ENGG. & BASIC TECHNOLOGY	HUBSCHIR KLANE	ENGLISH	LATEST	25.00	WILEY EASTERN Ltd. N. DELHI
44.	A TEXT BOOK OF ELECTRICAL M/C	P. C. ARORA	ENGLISH	LATEST	25.00	B. D. KATARIA & SONS LUDHIYANA
45.	THYRESISTOR & THEIR APPLICATION	M. RAMAMURTI	ENGLISH	LATEST	60.00	TATA Mc GRAW HILL
46.	POWER ELECTRONICS LABORATION SWITCHGEAR	O. P. ARORA	ENGLISH	1993-94	70.00	A. H. WHEELERS PVT. Ltd. ALLAHABAD, NEW DELHI
47.	RENEWABLE SOURCES OF ENERGY	BANSAL	ENGLISH			

List of standard Text Books(Hindi) recommended for diploma level institutions of Uttar Pradesh

1. DISCIPLINE : ELECTRICAL ENGINEERING

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	VEDUATE ENGINEERING -I	U. B. SINGH	HINDI	1993-94	65.00	B. TECH. PUBLISHERS
	VEDUATE ENGINEERING -II	U. B. SINGH	HINDI	1993-94	70.00	B. TECH. PUBLISHERS
2.	ELECTRICAL ENGG. DRAWING DESIGN & ESTIMATING	JAGGI & PAL & LAL	HINDI	1994	85.00	NAV BHARAT PRAKASHAN MEERUT
3.	ELECTRICAL INSTRUMENTS	T. D. BISHIT	HINDI	1994-95	60.00	ASIAN PB MUZZAFFAR NAGAR
4.	ELECTRICAL ENGINEERING MATERIAL	K. B. RAINA & S. K. BHATTACH-ARYA & T.JUNEJA	HINDI	1992	35.00	S. K. KATARIA & SONS
5.	ELECT. ENGG. DESIGN DRAWING & ESTIMATING	T. D. BISHT	HINDI	LATEST	125.00	ASIAN PUB. MUZZAFFAR NAGAR
6.	GENERATION & UTILISATION OF ELECTRICAL POWER	Dr. M. H. RAI	HINDI	LATEST	125.00	DEEPAK PRAKASHAN KHULA SANTAN MORAR (M.P.)
7.	INDUSTRIAL ELECTRONICS	D. C. GUPTA	HINDI	LATEST	150.00	-DO-
8.	UTILIZATION OF ELECTRICAL ENERGY	SHRMA. K. NATH	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN MERUTT
9.	POWER PLANT ENERGY	B. L. HARZAI S. R. SINGH	HINDI	LATEST	60.00	B. TECH PUBLISHERS LUCKNOW -226018
10.	INSTALLATION, MAINTENANCE & TESTING OF ELECT. ENGG EQUIPMENT	BASANT KUMAR	HINDI	LATEST	80.00	NAV BHARAT PRAKASHAN MERUTT
11.	NON-CONVENTIONAL SOURCE OF ENERGY & APPROPRIATE TECHNOLOGY	AGRAWAL & BHATNAGAR	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN MERUTT

Sl.No.	REFERENCE BOOKS	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	SOLAR ENERGY	DUFFIE & BACKMANN	ENGLISH			
2.	PRINCIPLES OF SOLAR ENERGY	FRANK KREITH & JAN F. KREIDER	ENGLISH			
3.	SOLAR ENERGY	MEINELL & MEINELL	ENGLISH			
4.	SOLAR ENERGY THEORY AND DESIGN OF SOLAR THERMAL SYSTEMS	W.S. WILLIAMS ET.AL.	ENGLISH			
5.	RENEWABLE ENERGY RESOURCES	TWIDELL & WEIR	ENGLISH			
6.	RENEWABLE ENERGY POWER FOR A SUSTAINABLE FUTURE	GODPEY BOYLE	ENGLISH			

Sl.No.	REFERENCE BOOKS	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
7.	NON-CONVENTIONAL ENERGY SOURCES	RAI G. D.	ENGLISH			
8.	SOLAR ENERGY	SUKHATME	ENGLISH			
9.	ENERGY FROM BIOMASS	DAVID HOFF	ENGLISH			
10.	ENERGY FROM BIOMASS	PALZ	ENGLISH			
11.	DIRECT ENERGY CONVERSION	STANLEY W. ANGRIST	ENGLISH			
12.	A GUIDE TO SMALL WIND ENERGY CONVERSION SYSTEMS	JOHN TWIDELL	ENGLISH			
13.	SOLAR ENERGY UTILISATION	ROY G. D.	ENGLISH			
14.	WATER POWER ENGINEERING CONVERSION SYSTEMS	BARROWS	ENGLISH			
15.	HAND BOOK ON SOLAR ENERGY	DR. ANNAMANI	ENGLISH			