

CURRICULUM
FOR
DIPLOMA PROGRAMME
IN
ELECTRICAL ENGINEERING

(5th& 6th Semester)

FOR THE STATE OF HIMACHAL PRADESH



(Implemented w.e.f. Session 2014-15)

Prepared by:-

Composite Curriculum Development Centre
Directorate of Technical Education,
Vocational & Industrial Training, Sundernagar(H.P.)

July, 2014

CONTENTS

SR.NO.	PARTICULARS	PAGE NO.
-	Contents	1
-	Preface	2
1.	Salient Features of the Diploma Programme	3
2.	Guidelines <i>(for Assessment of Student Centered Activities and Sessional assessment)</i>	4
3.	Study and Evaluation Scheme	5-6

FIFTH SEMESTER

5.1	ELECTRICAL MACHINE-II	7-9
5.2	ELECTRICAL POWER-II (T&D)	10-11
5.3	POWER ELECTRONICS & CONTROL OF DRIVES	12-14
5.4	ELECTIVE-I	15-22
5.5	ESTIMATING & COSTING IN ELECTRICAL ENGINEERING	23-24
5.6	GENERIC SKILLS & ENTREPRENEURSHIP DEVELOPMENT	25-27
5.7	MINOR PROJECT	28

SIXTH SEMESTER

6.1	BASICS OF MANAGEMENT	29-31
6.2	ENERGY MANAGEMENT	32-34
6.3	U.E.E	35-37
6.4	ELECTIVE-II	38-46
6.5	MAJOR PROJECT	47-50
6.6	PRACTICES IN COMMUNICATION SKILLS	51

PREFACE

India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in wide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.

Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.

While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:

- i) Major employment opportunities of the diploma holders.*
- ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*
- iii) Vertical and horizontal mobility of diploma pass outs for their professional growth.*
- iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.

Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.

We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.

Er. L.R. Rana
Head(CCDC)
Directorate of Technical Education,
Vocational & Industrial Training,
Sundernagar, Himachal Pradesh.

3rd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN ELECTRICAL ENGINEERING

1. SALIENT FEATURES

- | | |
|-------------------------------|---|
| 1) Name of the Programme : | Three year Diploma Programme
Electrical Engineering |
| 2) Duration of the Programme: | Three years (06 Semesters) |
| 3) Entry Qualification : | As prescribed by H.P. Takniki
Shiksha Board |
| 4) Intake : | As approved by H.P. Takniki
Shiksha Board |
| 5) Pattern of the Programme : | Semester Pattern |
| 6) Curriculum for : | 3 rd year of Three year Diploma
Programme(Technical Stream) |

7) Student Centred Activities:

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

2. GUIDELINES

2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

Distribution of 25 marks for SCA will be as follows:

- i. 5 Marks shall be given for general behaviour
- ii. 5 Marks for attendance shall be based on the following distribution:
 1. Less than 75% Nil
 2. 75-79.9% 3 Marks
 3. 80-84.9% 4 Marks
 4. Above 85% 5 Marks
- iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:
 1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
 2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
 3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

Note: *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamshala at the end of semester along with sessional record.*

2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
 - i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
 - ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
 - iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
 - i. 60% marks shall be awarded for performance in practical.
 - ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
 - iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
 - (i) 60% marks for sheets
 - (ii) 40% for test.

FIFTH SEMESTER (ELECTRICAL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
5.1	ELECTRICAL MACHINE-II	5	2	30	20	50	100	3	50	3	150	200
5.2	ELECTRICAL POWER-II (T&D)	5	-	50	-	50	100	3	-	-	100	150
5.3	POWER ELECTRONICS & CONTROL OF DRIVES	5	2	30	20	50	100	3	50	3	150	200
5.4	ELECTIVE-I 5.4.1 NON-CONVENTIONAL ENERGY SOURCES 5.4.2 ILLUMINATION ENGINEERING 5.4.3 MICROPROCESSORS AND MICROCONTROLLERS	4	2	30	20	50	100	3	50	3	150	200
5.5	ESTIMATING & COSTING IN ELECTRICAL ENGINEERING	4	-	50	-	50	100	3	-	-	100	150
5.6	* GENERIC SKILLS & ENTREPRENEURSHIP DEVELOPMENT	2	1	50	50	100	50	2	-	-	50	150
5.7	MINOR PROJECT	-	4	-	50	50	-	-	50	3	50	100
5.8	INDUSTRIAL TRAINING	-	-	-	50	50	-	-	50	-	50	100
5.9	STUDENT CENTRED ACTIVITIES	-	2	-	25	25	-	-	-	-	-	25
TOTAL		25	13	240	235	475	550	-	250	-	800	1275

* Common with other diploma programmes.

SIXTH SEMESTER(ELECTRICAL ENGINEERING)

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME									Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
				Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
6.1	*BASICS OF MANAGEMENT	3	-	50	-	50	100	3	-	-	100	150	
6.2	ENERGY MANAGEMENT	4	2	30	20	50	100	3	50	3	150	200	
6.3	U.E.E	5	2	30	20	50	100	3	50	3	150	200	
6.4	ELECTIVE-II 6.4.1 PLCs AND MICROCONTROLLERS 6.4.2 INDUSTRIAL AUTOMATION 6.4.3 TESTING & MAINTENANCE OF ELECTRICAL MACHINES	4	2	30	20	50	100	3	50	3	150	200	
6.5	MAJOR PROJECT	-	10	-	100	100	-	-	100	3	100	200	
6.6	*PRACTICES IN COMMUNICATION SKILLS	-	2	-	50	50	-	3	50	3	50	100	
6.7	S.C.A	-	4	-	25	25	-	-	-	-	-	25	
Total		16	22	140	235	375	400	-	300	-	700	1075	

* Common with other diploma programmes.

5.1 ELECTRICAL MACHINES-II

LTP
5 - 2

RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical engineering diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

DETAILED CONTENTS

1. Synchronous Machines

(24hrs)

- 1.1 Construction Feature of Stator and Rotor
- 1.2 Advantages of rotating field system
- 1.3 Different types of excitation system
- 1.4 Generation of three phase emf. and emf equation
- 1.5 Production of rotating magnetic field in a three phase winding
- 1.6 Concentrated and distributed windings, Concept of distribution factor and coil span factor and pitch factor
- 1.7 Effect of armature reaction on terminal voltage when synchronous generator Independently supplying load at unity lagging and leading power factor
- 1.8 Concept of synchronous impedance. Voltage regulation and its representation with phasor diagrams for various power factor loads.
- 1.9 Voltage Regulation by synchronous impedance method.
- 1.10 Need and necessary conditions for parallel operation of alternators. Synchronization of alternators with bus bars Synchroscope method and two lamp method.
- 1.11 Operation of synchronous machine as a motor –its starting methods.
- 1.12 Effect of change in excitation of a synchronous motor, concept of Synchronous condenser
- 1.13 Concept and Cause of hunting and its prevention
- 1.14 Rating and cooling of synchronous machines
- 1.15 Applications of synchronous machines (as an alternator, as asynchronous Condenser)

2. Induction Motors

(20hrs)

- 2.1 Salient constructional features of squirrel cage and slip ring 3-phase induction motors
- 2.2 Principle of operation of induction motor, slip and its significance
- 2.3 Effect of slip on various parameters of rotor circuit.
- 2.4 Power flow diagram and relationship between copper loss and the motor slip
- 2.5 Factors determining the torque, starting and running torque, maximum torque Torque-slip curve, stable and unstable zones
- 2.6 Effect of rotor resistance upon the torque slip relationship
- 2.7 Double cage rotor motor and its applications
- 2.8 Starting of 3-phase induction motors, DOL, star-delta, autotransformer
- 2.9 Testing of 3-phase motor on no load and blocked rotor test and to find Efficiency
- 2.10 Harmonics and its effects, cogging and crawling in Induction motors.

3. Fractional Kilo Watt (FKW) Motors (14hrs)

- 3.1 Single phase induction motors;
- 3.2 Nature of field produced (double field revolving theory and cross field theory) in single phase induction motor
- 3.3 Split phase induction motor
 - 3.3.1 Capacitors start and run motor
 - 3.3.2 Shaded pole motor
 - 3.3.3 Reluctance start motor
- 3.4 Alternating current series motor and universal motors
- 3.5 Single phase synchronous motor
 - 3.5.1 Reluctance motor
 - 3.5.2 Hysteresis motor

4. Special Purpose Machines (12 hrs)

Construction and working principle of linear induction motor, stepper motor, Servomotor, Submersible Motor, Introduction to Energy efficient motors, Brush less DC motors.

LIST OF PRACTICALS

1. *To plot relationship between no load terminal voltage and excitation current in a synchronous generator at constant speed*
2. *To Determination of the relationship between the field current and load current of an alternator, voltage and speed constant*
3. *To Determination of the relationship between the voltage and load current of an alternator, keeping excitation and speed constant*
4. *Determination of the regulation and efficiency of alternator from the open circuit and short circuit test.*
5. *Synchronization of poly phase alternators and load sharing by two Lamps Method and synchroscope method.*
6. *Determination of the effect of variation of excitation on performance of asynchronous motor.*
7. *Determination of efficiency by no load test and blocked rotor test on an induction motor.*
8. *Determination of effect of rotor resistance on torque speed curve of an wound rotor induction motor.*
9. *To study the effect of a capacitor on the starting and running of a single phase induction motor by changing value of capacitor and also reverse the direction of rotation of a single phase induction motor*

INSTRUCTIONAL STRATEGY

Teacher should lay-emphasis on development of understanding amongst students about basic principles of operation and control of electrical machines. This may be achieved by conducting quiz tests and by giving home assignments. The teachers should also conduct laboratories classes themselves encouraging each should to perform with his/her own hands and draw conclusions.

RECOMMENDED BOOKS

- 1) *Electrical Machines by SK Bhattacharya, Tata McGraw Hill, New Delhi*
- 2) *Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar*
- 3) *Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi*
- 4) *Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi*
- 5) *Electrical Machines by Samarjit Ghosh, Pearson Education (Singapore) Pte, Ltd.482, FIE Patparganj, Delhi 110092*
- 6) *Electrical Machines by DR Arora, Ishan Publications, Ambala City.*

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER
SETTER**

Sr.No	Topic	Time Allotted (Hrs)	Marks Allotted%
1	Synchronous Machines	24	40
2	Induction Motors	20	30
3	Fractional Kilo Watt Motors	14	20
4	Special Purpose Machines	12	10
	Total	70	100

5.2 ELECTRICAL POWER – II

(Transmission and Distribution of Electrical Power)

L T P
5 - -

RATIONALE

The majority of the polytechnic pass outs who get employment in State Electricity Boards have to perform various activities in the field of Generation, Transmission and Distribution of Electrical power. The range of these activities vary from simple operation and maintenance of equipment, lines, fault location, planning and designing of simple distribution schemes, executive and supervisory control in power stations, transmission and distribution networks in addition to administrative jobs including public relations. They should also be made aware of recent developments, current practices in the electricity departments, corporations and boards to keep them abreast with modern techniques in Transmission and Distribution of Electrical Power.

DETAILED CONTENTS

1. Transmission Systems (20hrs)

- 1.1 Layout of transmission system, selection of voltage for H.T and L.T lines, advantages of high voltage Transmission both AC and DC
- 1.2 Comparison of different system: AC versus DC for power transmission, conductor material and sizes from standard tables
- 1.3 Constructional features of transmission lines: Types of supports, types of insulators, Types of conductors, Selection of insulators, conductors, earth wire and their accessories, Transposition of conductors and string efficiency of suspension type insulators, Bundle Conductors.
- 1.4 Importance of sag, calculation of sag, effects of wind and ice related problems; Indian electricity rules pertaining to clearance
- 1.5 Electrical features of line: Calculation of resistance, inductance and capacitance without derivation in a.c. transmission line, voltage regulation, and concept of corona. Effects of corona and remedial measures.

2. Distribution System (14hrs)

- 2.1 Lay out of HT and LT distribution system, constructional feature of distribution lines and their erection. LT feeders and service mains; Simple problems on AC radial distribution system, determination of size of conductor
- 2.2 Preparation of estimates of HT and LT lines.
- 2.3 Constructional features of LT (400 V), HT (11 kV) underground cables, advantages and disadvantages of underground system with respect to overhead system

3. Substations: (14hrs)

- 3.1 Brief idea about substations; outdoor grid sub-station 220/132 KV, 66/33 KV outdoor substations, pole mounted substations and indoor substation
- 3.2 Layout of 33/11 kV/400V distribution substation and various auxiliaries and equipment associated with it.

4. Faults: (8 hrs)

Common type of faults in both overhead and underground systems, Symmetrical /unsymmetrical faults. Line to line fault, Single line to ground fault, double line to ground fault, 3-phase to ground fault open circuit.

- 5. Power Factor:** (6 hrs)
- 5.1 Concept of power factor
 - 5.2 Reasons and disadvantages of low power factor
 - 5.3 Methods for improvement of power factor using capacitor banks, VAR Static Compensator (SVC)

- 6. Various Types of Tariffs:** (8hrs)
- 6.1 Concept of Tariffs
 - 6.2 Block rate, flat rate, maximum demand and two part tariffs
 - 6.3 Simple problems

Note: Students may be taken to various Sub-stations. Students must be familiarized with present tariff system employed by State Electricity Boards.

INSTRUCTIONAL STRATEGY

Since this subject is field oriented, the students should be exposed to different types of Substations including grid stations before the actual class room teaching and make them familiar with the equipment and accessories installed over there. Their should be at least 5 visits during the year. The students may be asked to prepare notes while on visit and submit the report. After that Viva-voce be conducted to evaluate the knowledge gained during the field visit.

RECOMMENDED BOOKS

1. *Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi*
2. *Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi*
3. *Electrical Power – I by SK Sahdev, Unique International Publications, Jalandhar*
4. *Electrical Power System by VK Mehta, S Chand and Co., New Delhi*
5. *Electrical Power System by JB Gupta, SK Kataria and Sons, New Delhi*
6. *Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi*
7. *Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi*
8. *Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi*

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr.No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Transmission Systems	20	30
2	Distribution System	14	20
3	Substations	14	20
4	Faults	8	10
5	Power Factor	6	10
6	Various Types of Tariffs	8	10
	Total	70	100

5.3 POWER ELECTRONICS AND CONTROL OF DRIVES

L T P
5 - 2

Aim :-

1. *The field of electrical engineering is generally segmented into three major areas – Electronics, Power and Control.*
2. *Power Electronics involves a combination of these three areas. In broad terms, the function of power electronics is to process and control the electrical energy by supplying voltage and current in a form that is optimally suited to the load. Now a day's electrical machine are controlled by Power Electronics methods.*
3. *The various conventional control & relays are replaced by electronic control & relays, employing solid state power semiconductor devices.*

Objective :-

The students will be able to:

1. *Explain the construction and operation of power semiconductor devices and plot their characteristics.*
2. *Draw the circuit diagrams and explain the working of controlled rectifiers with appropriate waveforms.*
3. *Draw the circuit diagrams and explain the working of different types of Inverters with appropriate waveforms.*
4. *Explain the Voltage and Frequency Control Methods used in Inverters.*
5. *Draw the circuit diagrams and explain the working of different types of choppers with appropriate waveforms.*
6. *Apply the power electronic methods of controls in Electrical Engg. field.*

DETAILED CONTENTS

01.Power Semiconductor Devices: (20hrs)

- 1.1 Thyristor (SCR)
- 1.2 Construction, Operation and Symbol
- 1.3 V-I Characteristics
- 1.4 Thyristor Turn Methods: Voltage Triggering, Gate Triggering, dv/dt Triggering and Light Triggering.
- 1.5 Gate Control: DC Gate Signal, AC Gate Signal and Pulse.
- 1.6 Thyristor Turn off Process
- 1.7 Thyristor Specifications and Ratings Voltage Ratings, Current Ratings, Power Ratings and Temperature Ratings.
- 1.8 Heat Sinks and Mountings
- 1.9 Thyristor Family: Symbols & V-I Characteristics Of TRIAC, DIAC, UJT
- 1.10 Relaxation Oscillator using UJT

02.Converters: (10hrs)

- 2.1 – Introduction
- 2.2 – Single Phase Fully Controlled Half Wave Converter
 - With Resistive Load
 - With RL Load and Freewheeling Diode.
- 2.3 - Single Phase Fully Controlled Full Wave Converter
 - With Resistive Load
 - With RL Load.
- 2.4 - Single Phase Fully Controlled Bridge Converter
 - With Resistive Load
 - With RL Load
- 2.5 – Three Phase Fully Controlled Bridge Converter

- With RL Load.
- 2.6 – Comparison of 3 and 1-Phase Converters.
- 2.7- Effect of Source Impedance on Converter Operation. Input output waveforms.
- 2.8 Cyclo-converters
 - 2.8.1 Introduction, classification , Working Principle and Applications
- 2.9 Dual Converters, Introduction, classification, Working Principle and Applications

03. Inverters: (10hrs)

- 3.1 - Introduction
- 3.2 – Classification: 1-phase & 3-phase Inverters, Line Commutated & Forced Commutated Inverters, Series, Parallel, & Bridge Inverters.
- 3.3 – Series Inverter
 - Operation of Basic Series Inverter Circuit
 - Modified Series Inverter
- 3.4 – Parallel Inverter
 - Operation of Basic Parallel Inverter Circuit
- 3.5 – Single Phase Bridge Inverter
 - Half Bridge Inverter
 - Full Bridge Inverter

04. Choppers: (10hrs)

- 4.1 – Introduction
- 4.2 – Chopper Principle
- 4.3 – Control Techniques:
 - Constant Frequency System
 - Variable Frequency System
- 4.4 – Classification of Choppers:
 - Class A, Class B, Class C, Class D and Class E
- 4.5 - Commutations Methods for Choppers:
 - Auxiliary Commutation, Load Commutation
- 4.6 – Step Up Chopper

05. Power Electronic Applications: (10hrs)

- 5.1 – DC Drives:
 - 5.1.1 – Speed control of DC series motor with single phase and three phase half and full controlled converter, step up and step down chopper.
 - 5.1.2 – Introduction to DC servo motor, Speed control of DC servomotor.
- 5.2 – AC Drives:
 - 5.2.1 – Speed control of three phase Induction Motor with Variable frequency PWM VSI, Variable frequency square wave VSI, Variable frequency CSI, Variable frequency, Variable Voltage.

6. Other Applications: (10hrs)

- Static Circuit Breakers (DC & AC).
- Induction Heating Control.
- Di-electric Heating Control.
- Battery Charging Control.
- Static Excitation System for Alternators.
- Static VAR Compensation System.

Practical:

Skills to be developed:

Intellectual skills:

1. Select appropriate devices and instruments
2. Testing & troubleshooting Motor Skills:
 1. Accuracy of Measurement
 2. Proper connections
 3. Draw characteristics

List of Practicals:

- (1) To identify the terminals and plot V-I Characteristics of Thyristor.
- (2) To study Full Wave Rectifier Using SCR and UJT.
- (3) To study Parallel Inverter Using SCR.
- (4) To study Bridge Rectifier Using SCR and UJT.
- (5) To study series Inverter Using SCR.
- (6) To study Chopper Using SCR.
- (7) To study Circuit Breaker Using SCR.
- (8) To study Battery Charger Using SCR.
- (9) TO Perform Speed control of DC series motor by static armature voltage control using single phase half/full controlled converter.

Text Books:

Name of Authors	Titles of the Book	Name of the Publisher
1. B. R. Gupta ,V. Singhal,	<i>Power Electronics</i>	<i>S. K. Kataria& Sons</i>
2. Muhammad H. Rashid	<i>Power Electronics</i>	<i>Prentice-Hall of India Pvt. Ltd.</i>
3. M. D. Singh, K. B. Khanchandani	<i>Power Electronics</i>	<i>Tata McGraw-Hill</i>
4. G. K. Dubey	<i>Fundamentals of Electric Drives</i>	<i>Narosa Publishing House</i>
5. V. Subrahmanyam	<i>Electric Drives – Concepts and Applications</i>	<i>Tata McGraw-Hill</i>

5.4.1 NON-CONVENTIONAL ENERGY SOURCES

L T P

4 - 2

RATIONALE

Energy is a crucial input in the process of economic, social and industrial development. High-energy consumption has traditionally been associated with higher quality of life, which in turn is related to Gross National Product (GNP). Since the conventional energy resources are under strain of depletion, it is high time to tap the non-conventional energy sources. The electrical diploma holder will have to face this challenge in future life. Therefore this subject is introduced as an elective subject in diploma programme to familiarize the diploma students with non-conventional engineering sources, so that they may exploit them in near future.

DETAILED CONTENTS

1. **Introduction:** (4hrs)
Importance of Non-conventional sources of energy, Present Scenario, Future Prospects, Economic Criteria
2. **Solar Energy:** (8hrs)
Principle of conversion of Solar radiation into heat, Photo-voltaic cell, Electricity generation, Application of solar energy like Solar water heaters, Solar Furnaces, Solar cookers, Solar lighting, Solar pumping.
3. **Hydro Energy:** (6 hrs)
Hydro-electric Power Plants, Mini and Micro hydro-electric power generation.
4. **Bio-energy:** (8 hrs)
Bio-mass Conversion Technologies- wet and dry processes. Methods for obtaining energy from biomass. Power generation by using gasifier.
5. **Wind Energy:** (6 hrs)
Wind Energy Conversion, Windmills, Electricity generation from wind- Types of wind mills, local control, energy storage
6. **Geo-thermal and Tidal Energy:** (8hrs)
Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion. Steam Generation and electricity generation.
7. **Magneto Hydro Dynamic (MHD) Power Generation** (2 hrs)
8. **Chemical Energy Sources:** (8hrs)
Design and operating principles of a fuel cell, conversion efficiency, work output and emf of fuel cells, applications, storage battery characteristics, types, applications, maintenance of batteries.
9. **Thermo Electric Power:** (6 hrs)
Basic principle, performance analysis of thermo electric power generation, thermoelectric materials and their application.

INSTRUCIONAL STRATEGY

The teacher should make the student s aware about the depletion of energy sources and the availability of alternate sources of energy. Their feasibility and limitations. The need for adopting non-conventional energy sources should be made clear to students. Teacher must give practical application of these energy sources in nearby surrounding areas.

RECOMMENDED BOOKS :

- 1) *Solar Energy – Principles of thermal collection and Storage* SP Sukhatme, Tata McGraw Hill Publication, New Delhi.
- 2) *Solar Energy Utilization;* GD Rai ; Khanna Publishers, New Delhi.
- 3) *Reviews of Renewable Energy Sources, Vol. 3, Edited by MS. Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.*
- 4) *Renewable Energy Sources and Conversion Technology* by NK Bansal, Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co. Ltd New Delhi.
- 5) *Energy Today and Tomorrow;* MaheshwarDayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
- 6) *Energy Technology (non-conventional, renewable and conventional)* by S Rao and BB Parulekar, Khanna Publishers, New Delhi
- 7) *Non-Conventional Energy Resources* by RK Singal, SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction	4	5
2	Solar Energy	8	15
3	Hydro Energy	6	10
4	Bio-energy	8	15
5	Wind Energy	6	10
6	Geo-thermal and Tidal Energy	8	15
7	Magneto Hydro Dynamic	2	5
8	Chemical Energy Sources	8	15
9	Thermo Electric Power	6	10
Total		56	100

List of Practicals:-

1. Study of Photo voltaic cell.
2. Use of Photo voltaic cell grid in street-lighting.
3. Study of solar/wind turbine generator in a nearby industry.
4. Visit & Study of geo-thermal power plant in a nearby area.(e.g. Manikaran)

5.4.2 ILLUMINATION ENGINEERING

L T P
4 - 2

Aim:-

1. To measure the level of Illumination
2. To study various types of lamps.
3. To design Illumination schemes for various applications in residential, commercial & industrial Locations

Objective :-

The student will be able to:

1. Measure the level of Illumination.
2. Differentiate between the various types of lamps.
3. List of various lighting accessories of components.
4. Design a control circuit for Illumination.
5. Design Illumination schemes for various applications in residential, commercial & Industrial Locations.
6. Execute Illumination scheme for residential, commercial & industrial locations.

DETAILED CONTENTS

1 Fundamentals of Illumination	06Hours	10 Marks
1.1 Illumination Terminology		
1.2 Laws of Illumination		
1.3 Featuring of good Illumination scheme		
1.4 Advantages of good Illumination scheme		
1.5 Measurement of level of Illumination		
2Lamps& Lighting Accessories	10Hours	20Marks
2.1 Types of lamps: ARC lamps, HPMV lamps, Sodium Lamps, CFL Lamps, Metal halides, LED lamps		
2.2 Neon Sign Tubes.		
2.3 Neon Lamps.		
2.4 Halogen Lamps.		
2.5 Special purpose Lamp.		
2.6 Lighting accessories.		
3 Illumination Control & Control Circuits	08Hours	15Marks
3.1 Purpose of lighting control		
3.2 Dimmer Transformer & their types		
3.3 Electronic Dimmer		
3.4 Enhancing Lighting control.		
3.5 Control circuits for lamps (specify)		
4 Illumination for Interior Applications	12Hours	20Marks
4.1 Standard for various situations of Interior Illumination		
4.2 Design Techniques		
4.3 Design considerations for Interior location of Residential, Commercial, Industrial premises		
4.4 Design Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit.		

5 Illumination for Outdoor Applications**12Hours****20Marks**

- 5.1 Factory Lighting
- 5.2 Street Lighting
- 5.3 Flood Lighting
- 5.4 Railway Lighting
- 5.5 Lighting for Advertisement/Hoardings
- 5.6 Sports Lighting

6 Lighting for Special Applications**08Hours****15Marks**

- 6.1 Agriculture & Horticulture
- 6.2 Health Care Centers / Hospitals
- 6.3 Decorating Purposes
- 6.4 Stage Lighting
- 6.5 Aquariums & Shipyards

Practical:

Skill to be developed:

Intellectual Skills:

1. Apply different Designing Skills.
2. Select proper equipment.

Motor Skills:

1. Measurement of Illumination.
2. Drawing skills.

List of Practicals:

1. To Measure Illumination by luxmeter.
2. Study the various lamps available in the market & collect the technical information.
3. Visit to nearby lamp manufacturing industry.
4. Prepare a report of different luminaries available in the market & collect the technical data (Visit local market / Use internet for data collection).
5. Study the different lighting accessories required for varies types of lamps.
6. Design an Illumination scheme for a garden of medium size.
7. Design an Illumination scheme for a conference room of medium size.
8. Design an Illumination scheme for a workshop for fine work of medium size.
9. Design an Illumination scheme for a medium size Hotel / Hospital /Shopping complex.

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Jack L. Lindsey	Applied Illumination Engineering		The Fairmont Press Inc.
R. H. Simons, Robert Bean	Lighting Engineering: Applied Calculations		Architectural Press(ISBN0750650516)
Casimer M Decusatis	Handbook of Applied Photometry		Springer(ISBN1563964163)

2. Video Cassettes/ CDs

3. IS/International Codes : IS 2418, 9974, 9900, 2218, 5077, 4012, 4013, 1885, 1947, 4347, 6665, 3287, 1777, 3646, 2672, 10894, 1944, 10322, 2140

Suggested List of Laboratory Experiments :

- 1 To Measure Illumination by luxmeter.
- 2 Design an Illumination scheme for a garden of medium size
- 3 Design an Illumination scheme for a workshop for fine work of medium size.

Suggested List of Assignments/Tutorial :

- 1 Study the various lamps available in the market & collect the technical information
- 2 Prepare a report of different luminaries available in the market & collect the technical data (Visit local market / Use internet for data collection).
- 3 Visit to nearName of the Course : ELECTRICAL ENGINEERING GROUP

5.4.3 MICROPROCESSORS AND MICROCONTROLLERS

L T P
4 - 2

Aim :-

1. Today microprocessors and microcontrollers have become an integral part of all automatic and semi-automatic machines. Therefore there is a growing need of engineers / technicians in this field. Hence, it is necessary to study microcontroller basics, hardware and its programming.
2. This subject covers microprocessor 8085 and microcontroller 8051 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microcontroller and microprocessor based applications.

Objective :-

The student will be able to

1. Describe architecture and operation of microprocessor 8085
2. Develop assembly language programs using instruction set of 8085
3. Describe architecture and operation of microcontroller 8051
4. Develop assembly language programs using instruction set of 8051
5. Design and develop microcontroller based systems
6. Explain various applications of microcontrollers

DETAILED CONTENTS

1. Microprocessor 8085	8Hours	15 Marks
1.1 Evolution of microprocessors		
1.2 Architecture of 8085		
1.3 Pin diagram		
1.4 Control signals		
1.5 Multiplexing of address & Data Bus		
2. 8085 Assembly Language Programming	8Hours	15Marks
2.1 Programming Model of 8085		
2.2 Addressing Modes		
2.3 Instruction classification, Instruction format		
2.4 Instruction set		
2.5 Stacks & subroutines		
2.6 Assembly Language programming		
3. Microcontroller Basics	4Hours	8Marks
3.1 Introduction and applications		
3.2 Comparison between microcontrollers and microprocessors		
3.3 Evolution of microcontrollers		
3.4 Commercial microcontroller devices		
4. 8051 Architecture	5Hours	8Marks
4.1 Block diagram of 8051 microcontroller		
4.2 Registers in 8051		
4.3 General purpose or working registers		
4.4 Stack Pointer and Program counter		
4.5 Special function registers (SFR)		
4.6 Program Status word		
4.7 Data pointer (DPTR)		
4.8 Timer registers		
4.9 Ports		
4.10 Control registers		

5. 8051 connections, I/O ports and memory organization	5Hours	10Marks
5.1 8051 pin description		
5.2 8051 connections		
5.3 Parallel I/O ports		
5.4 Memory organization		
6. 8051 addressing modes and instructions	8Hours	12Marks
6.1 8051 addressing modes		
6.2 8051 instruction set		
6.3 8051 assembler and assembling 8051 program		
6.4 Software simulators of 8051		
6.5 8051 instructions and simple programs		
7. 8051 interrupts, timer/counters and serial communication	6Hours	12Marks
7.1 Interrupts in 8051		
7.2 Initializing 8051 interrupts		
7.3 Interrupt priorities		
7.4 Timers and counters, timer counter modes		
7.5 Serial communication, serial communication modes		
8. Applications of microcontrollers	12Hours	20Marks
8.1 Square wave and rectangular wave generation		
8.2 Pulse generation		
8.3 Pulse width modulation		
8.4 Frequency counter		
8.5 Interfacing small keyboards		
8.6 Interfacing LCD display,		
8.7 Interfacing D/A and A/D converters		
8.8 Interfacing relay		
8.9 Interfacing stepper motor		
8.10 Interfacing DC motor.		

Practical:

Intellectual Skills:

1. Logical development
2. Programming skills

Motor Skills:

1. Data entry, Error Correction and Execution of assembly language programmes
2. Connection Skills

List of Practicals:

Using microprocessor 8085 kit:

1. *Demonstration and study of microprocessor kit*
2. *Program for addition of and subtraction of two hexadecimal numbers*
3. *Program for finding largest / smallest number*
4. *Program for arranging numbers in ascending / descending order*
5. *Program for 16 bit addition*
6. *Program for data masking*
7. *Program for multiplication of two eight bit numbers*
8. *Program using JMP Instruction*
9. *Two programs using loop & Counter*

Using microcontroller 8051 kit:

1. Demonstration and study of microcontroller kit
2. Demonstration and use of software simulator / assembler
3. Programming examples (any two) – Data transfer instructions
4. Programming examples (any two) – Logical Operations
5. Programming examples (any two) – Jump and Call instructions
6. Demonstration and testing of the following applications (Any four)
 - i. Keyboard Interface
 - ii. LCD display Interface
 - iii. D/A or A/D converter Interface
 - iv. Relay Interface
 - v. Stepper motor control
 - vi. DC motor control
 - vii. Any other practical application using microcontroller 8051

Text Books:

Name of Authors	Titles of the Book	Name of the Publisher
Ajay VDeshmukh	Micro controllers theory and applications	TMH New Delhi
Kenneth J Ayala,	8051 microcontrollers architecture Programming and Applications	International Thomson publishing, India
B. Ram	Microprocessor & Microcomputer	S. Chand publications
Ramesh Gaonkar	Microprocessor Architecture Programming, and Applications with the 8085	Penram International

5.5 ESTIMATING AND COSTING IN ELECTRICAL ENGINEERING

L T P
4 - -

RATIONALE

A diploma holder in electrical engineering should be familiar to Indian Standards and relevant Electricity Rules. Preparation of good estimates is a professional's job, which requires knowledge of materials and methods to deal with economics. The contents of this subject have been designed keeping in view developing requisite knowledge and skills of estimation and costing in students of diploma in electrical engineering.

DETAILED CONTENTS

1. Introduction

(8hrs)

Purpose of estimating and costing, proforma for making estimates, preparation of materials schedule, costing, price list, tender document, net price list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills. Tenders – its constituents, finalization, specimen tender.

2. Types of wiring

(12hrs)

Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire-gauge and tables (to be prepared/arranged)

3. Estimating and Costing:

(24hrs)

- 3.1 Domestic installations; standard practice as per IS and IE rules. Planning of circuits, sub-circuits and position of different accessories, electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (single storey and multi-storey buildings having similar electrical load)
- 3.2 Industrial installations; relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of list of materials, estimating and costing exercises on workshop with single-phase, 3-phase motor load and the light load (3-phase supply system)
- 3.3 Service line connections estimate for domestic and Industrial loads (over-head and Under- ground connections) from pole to energy meter.

4. Estimating the material required for

(12 hrs)

- 4.1 Transmission and distribution lines (overhead and underground) planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations
- 4.2 Substation: Types of substations, substation schemes and components, estimate of 11/0.4 KV pole mounted substation up to 200 KVA rating, earthing of substations, Key Diagram of 66 KV/11KV Substation.

NOTE:- Schedule of Rates may be supplied in the examination:

INSTRUCTIONAL STRATEGY

Teacher should identify/prepare more exercises on the pattern shown above. The teacher should make the students confident in making drawing and layouts of electrical wiring installations and doing estimation and costing leading to preparation of small tender document.. This capability will lead the students to become a successful entrepreneur. Take the students to field/laboratory and show the material and equipment.

RECOMMENDED BOOKS

1. *Electrical Installation, Estimating and Costing* by JB Gupta, SK Kataria and Sons, New Delhi
- a) *Estimating and Costing* by SK Bhattacharya, Tata McGraw Hill, New Delhi
- b) *Estimating and Costing* by Surjeet Singh, Dhanpat Rai & Co., New Delhi
- c) *Estimating and Costing* by Qurashi
- d) *Estimating and Costing* by SL Uppal, Khanna Publishers, New Delhi
- e) *Electrical Estimating and Costing* by N Alagappan and B Ekambaram, TMH, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction	8	20
2	Types of wiring	12	20
3	Estimating and Costing	24	40
4	Estimating the material required for	12	20
Total		56	100

5.6 GENERIC SKILLS & ENTREPRENEURSHIP DEVELOPMENT

L T P
2 - 1

RATIONALE

In present scenario, there is an urgent need to develop right kind of attitude, knowledge and skills amongst the Diploma engineers leading them to achieve gainful wage/ self-employment. There is a huge gap in perceptions of employers and employees regarding meeting the job requirements. Also the dual challenges of competing in global working environment and keeping pace with the rapid technological advancements call for re-design of curricula and thus enabling the importance of employability or generic skills. Entrepreneurship development aim at developing conceptual understanding for setting up owns' business/enterprise to cope up with the problem of unemployment and also to promote the socio- economic development of our country.

Both the subject areas, "generic skills and entrepreneurship development" are supplementary to each other. Knowledge and skills of these must be imparted to diploma engineering students for enhancing their employability and confidence in their personal and professional life.

DETAILED CONTENTS

- | | | |
|-----------|---|-----------------|
| 1. | Introduction to Generic Skills | (02 Hrs) |
| 1.1 | Concept and importance | |
| 1.2 | Local and global scenario | |
| 1.3 | Concept of life-long learning (LLL) | |
| 2. | Self Management and Development | (07 Hrs) |
| 2.1 | Concept of Personality Development, Ethics and Moral values | |
| 2.2 | Concept of Intelligence and Multiple intelligence Types viz, linguistic, mathematical & Logical reasoning, emotional, and social intelligence (interpersonal & intrapersonal). | |
| 2.3 | Concept of Physical Development; significance of health, hygiene, body gestures & kinesics. | |
| 2.4 | Time Management concept and its importance | |
| 2.5 | Intellectual Development; reading skills (systematic reading, types and SQ5R), speaking, listening skills, writing skills (Note taking, rough draft, revision, editing and final drafting), concept of critical Thinking and problem solving (approaches, steps and cases). | |
| 2.6 | Psychological Management; stress, emotions, anxiety and techniques to manage these. | |
| 2.7 | ICT & Presentation skills; use of IT tools for good and impressive presentations. | |
| 3. | Team Management | (03 Hrs) |
| 3.1 | Concept of Team Dynamics. Team related skills such as; sympathy, empathy, leading, coordination, negotiating and synergy. Managing cultural, social and ethnic diversity. | |
| 3.2 | Effective group communication and conversations. | |
| 3.3 | Team building and its various stages like forming, storming, norming, performing and adjourning (Bruce Tuckman's five stage Model) | |
| 4. | Project Management | (02 Hrs) |
| 4.1 | Concept of Management and features | |
| 4.2 | Stages of Project Management; initiation, planning, execution, closing and review (through case studies) | |
| 4.3 | SWOT analysis concept. | |

5. Introduction to Entrepreneurship (02 Hrs)

- 5.1 Entrepreneurship, Need of entrepreneurship, and its concept, Qualities of a good entrepreneur
- 5.2 Business ownerships and its features; sole proprietorship, partnership, joint stock companies, cooperative, private limited, limited, public limited, PPP mode.
- 5.3 Types of industries viz, micro, small, medium and large

6. Entrepreneurial Support System (features and roles in brief) (03 Hrs)

District Industry Centres (DIC's), State Financial Corporation's (SFC's), Small Industries Service Institutes(SISI), Commercial Banks, Micro Financing Institutions, SIDBI, NABARD, National Small Industry Corporations (NSIC), Cooperative Societies and Venture Capitalists. Various Consultancy Organizations; HIMCON, Khadi and Gramodyog Board (H.P.) etc.

7. Market Study and Opportunity Identification (04 Hrs)

Types of study; primary and secondary, product or service identification, assessment of demand and supply, type of surveys and important features; qualitative, empirical, schedules, questionnaire, interview.

8. Project Report Preparation (05 Hrs)

- 8.1 Preliminary Report, Techno-Economic Feasibility Report, Detailed Project Report (DPR) and illustration of these through examples.
- 8.2 Exercises on writing project reports of micro and small projects.

List of Practical Exercises

1. *Understanding Self Management and Development (Related to Chapter 02); through examples, cases, exercises, panel discussions, seminars, meditation and yoga techniques.*
2. *Team Management (Related to chapter 03); through examples, cases, role plays, group discussions and panel discussions.*
3. *Market Study and Opportunity Identification (Related to Chapter 07); through literature reviewing, making questionnaires, conducting mock interviews and analysing data for product/service identification and demand assessment.*
4. *Project Management and Project Report Preparation (Related to chapter 04 and 08); through exercises on making project reports on micro and small enterprises. Case studies and SWOT analysis of projects can be taken.*

Instructional Strategy

Since the emphasis of present training need and work requirements is on budding entrepreneurs as well as intelligent and multi skilled work force. Therefore skill development and knowledge imparting should be focussed on generic and entrepreneurial skill development. Thus instructional strategy of the subject should be more practical oriented and theories must be taught up to conceptual or informal levels. Different methodologies may be used with inclusive approach and must be supported with different training tools such as group and panel discussions , role plays, case studies, field surveys through questionnaires, schedules and interviews, presentations, seminars and expert talks in practical lectures and through student centred activities. Students may also be provided with extracted study material and handouts too.

Recommended Books:

1. *Generic Skill Development Manual, MSBTE, Mumbai*
2. *Lifelong Learning, Policy Brief (www.oecd.org)*
3. *Towards Knowledge Society, UNESCO Publication, Paris*
4. *Human Learning, Ormrod*
5. *What Work Requires of Schools? SCANS Report: U.S. Department of Labour*
6. *Entrepreneurship Development by CB Gupta and P Srinivasan: Sultan Chand and sons: New Delhi*
7. *Entrepreneurship Development by S. L. Gupta and Arun Mittal: IBH Publication*
8. *A Handbook of Entrepreneurship, Edited by B S Rathore and Dr. J S Saini*
9. *Entrepreneurship Development and Small Business Enterprises by Poornima M: Pearson Education India*
10. *Handbook of Small Scale Industry by P M Bhandari*

Inspirational Books

1. *Stay Hungry stay Foolish by Rashmi Bansal*
2. *An Autobiography by Lee Iacocca*
3. *Steve Jobs: The Biography by Walter Isaacson*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted %
1	2	7
2	7	26
3	3	10
4	2	7
5	2	10
6	3	10
7	4	15
8	5	15
Total	28	100

5.7 Minor Project

LTP

- - 4

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the student will be able to comprehend concepts, principles and practices taught in the classroom and their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

Depending upon the interests of the students and location of the organization the student may be asked for:

Market Study in the following cases:

1. Various types of cables available in the market, their current rating/ specifications, different makes/ manufacturing companies (minimum three), comparison of cost between different makes.
2. Various types of domestic/ wiring components such as switches, sockets, holders etc., their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
3. Various types of protective devices used in domestic and industrial wiring such as MCBs, ELCB/RCCB, fuses etc. their specifications, make (minimum three), and comparison of cost between different makes.
4. Various types of electric lamps (luminaries) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
5. Various types of Electrical Appliances (domestic and commercial) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes. (Compare any one type)

NOTE:-The students of the class may be divided into five groups and work may be assigned to each group as per their interest.

The components of evaluation will include the following:

Component	Weightage
a) Punctuality and regularity	15%
b) Initiative in learning new thing	15%
c) Relationship with others/workers	15%
d) Project Report/ Technical report	55%

6.1 BASICS OF MANAGEMENT

L T P
3 - -

RATIONALE:

Diploma holders are expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Some topics like Structure and ownership of Organization, Leadership, Motivation, Customer Relationship Management (CRM), Legal Environment of Business, Environmental Management, Accident and Safety: Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject.

DETAILED CONTENTS

1. **Introduction:** (12 hrs)
Definition and concept of management, functions of management- planning, organizing, staffing, coordinating and controlling. Various areas of management-
 - (a) Human Resource Management(HRM)-Manpower recruitment and selection, induction , training and development and performance appraisal.
 - (b) Financial Management- Meaning of financial management, its importance, various sources of finance- long term and short term. Concept of Internal Rate of Return(IRR), Net Present Value (NPV) and Average Rate of Return.
 - (c) Marketing Management- Product life cycle, concept of pricing, promotion strategies- advertising, sales promotion and market research.
 - (d) Material Management – Inventory management, concept of economic order quantity and waste management.

2. **Structure and Ownership of Organization:** (04 hrs)
Concept and structure of an organization, hierarchical management structure (top, middle and lower level management), functional management structure and matrix organizational structure. Types of business ownership (salient features)- Sole Proprietorship, Partnership, Joint Stock Companies and Cooperative Ownership.

3. **Leadership:** (02 hrs)
Meaning, importance , types of leadership and qualities of a good leader.

4. **Motivation:** (04 hrs)
Concept and importance of motivation-drives and incentives, types of motivation and theories of motivation- Abharam Maslow Theory and Herzberg Two Factor Theory.

5. **Customer Relationship Management:** (04hrs)
Need, various types of customers, customer satisfaction, Customer Satisfaction Index(CSI) and its significance in playing effective role of engineers in changing scenario.

6. **Legal Environment and Business:** (08 hrs)
 - a) Various labour laws and their necessity. Salient features of Income Tax Act – computation of income tax on salary income, Sales and Excise Tax Act-VAT & Excise duty and Factory Act. 1948.
 - b) Labour Welfare Schemes including wage payment types, system of wage payment and incentives.

- c) Intellectual Property Rights(IPR)- Concepts, infringements and remedies related to patents, copy rights, trademarks and designs.
- d) Accident and Safety- Meaning and concept of accident and safety, causes, safety precautions and various measures after accidents.

7. Total Quality Management: (04 hrs)
 Meaning and concept of Total Quality Management(TQM), various factors/measures to achieve TQM in an organization. Standards and Codes-National & International.

8. Environmental Management: (04 hrs)
 Concept of ecology and environment, factors contributing to air pollution, water pollution and noise pollution. Different measures to control pollution. Disaster management-features and measures.

INSTRUCTIONAL STRATEGY:

Generally the diploma holders occupy middle level managerial positions in an organization, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different topics related to management. Some of the topics may be taught using question answer, assignment or seminar. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organisations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS:

1. *Principles of Management by Philip Kotler TEE Publication*
2. *Principles and Practice of Management by ShyamalBannerjee: Oxford and IBM Publishing Co, New Delhi.*
3. *Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co.: 7, West Patel Nagar , New Delhi.*
4. *Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.*
5. *Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.*
6. *Essentials of Management by H Koontz, C O' Daniel , Mc Graw Hill Book Company, New Delhi.*
7. *Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi*
8. *Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.*
9. *Intellectual Property Rights and the Law by Dr. GB Reddy.*
10. *Service Quality Standards, Sales & Marketing Department, MarutiUdyog Ltd.*
11. *Customer Relationship Management: A step-by-step approach, Mohamed &Sagadevan Oscar Publication, Delhi*
12. *Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi*
13. *Environment Engineering by GN Pandey & GC Pandey, Tata McGraw Hill Publication.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	4	10
3	2	08
4	4	12
5	4	10
6	8	18
7	4	10
8	4	12
TOTAL	42	100

6.2 Energy Management

L T P
4 - 2

Aim:-

1. To study causes for limited growth of conventional energy sources and limitations of non-Conventional sources of energy
2. To study methods of energy conservation for different load conditions
3. To Select appropriate tariff system and methods for reducing electricity consumption and Energy saving.

Objective:-

The students will be able to:

1. List causes for limited growth of conventional energy sources and limitations of non conventional sources of energy.
2. Suggest methods of energy conservation for different load conditions.
3. Select appropriate tariff system and methods for reducing electricity consumption and energy saving. Apply Tools for energy audit and recommend measures for energy conservation.

DETAILED CONTENTS

1. Energy Review of various energy sources, Need of energy conservation and energy audit. **04Hours 10Marks**
2. Energy Conservation: Lighting energy: methods/Techniques of efficient lighting. Heating: methods/Techniques of energy saving in Furnaces, Ovens and Boilers. Cooling: methods/Techniques of Energy Saving in Ventilating systems and Air Conditioners Motive power, Energy Efficient Motors, and Efficient use of energy in Motors with the help of voltage reducers, automatic star/ delta converters . Power factor improvement devices and soft starters/Variable Frequency Drives. Amorphous Core Transformers Cogeneration -Types and Advantages. **12Hours 20Marks**
- 3 Tariffs and Energy Conservation in Industries: Energy cost and Recent MSEB tariffs, Application of Tariff System to reduce Energy bill, Energy Conservation by improving load factor and power factor. **08Hours 15Marks**
- 4 Energy Conservation in Transmission and Distribution Systems: Reactive power compensation, demand side management, system voltage optimization and phase current balancing, Losses in transmission and distribution system and its minimization **10Hours 15Marks**
- 5 Energy and the Environment: Environment and social concerns related to energy utilization, The greenhouse effect, Global Warming and its effect, Pollution, Acid Rains, Global Energy and environment Management. **06Hours 15Marks**
- 6 Energy Audit: Procedure of Energy audit, ABC analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. IE rules and regulations for energy audit, Electricity act 2003(Numerical) **16Hours 25Marks**

Practicals:

Skill to be developed:

Intellectual Skills:

1. Identify different methods used for energy conservation.
2. Understand the importance of energy conservation.
3. Select proper tariff for given industry/institute.
4. Collect technical information regarding electricity act.

Motor Skills:

1. Prepare energy audit report.
2. Write visit report.
3. Use different methods of energy conservation.
4. Use of energy saving devices.

List of Practical:

1. Energy saving by using electronic ballast as compared to conventional choke.
2. Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.
3. Make a survey of 01 establishment to identify different methods used for energy conservation.
4. Prepare Energy audit report for Industry/workshop/ Institute or its on section.

(Ask to search on the website of power ministry and MERC for Electricity act 2003 and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.)

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Siemens	Power Factor Correction	Vol.38 2005	New Age
T.Gonen	Electric Power Distribution System	Engg.	Tata McGraw Hill
M.J. Steinberg and T.H.	Economy Loading of Power plant and Electric system		John Willey and sons Smith
C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy		NewAge 2004

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Steven R. Patrick, Dale R. Patric	Energy conservation Guide book		Fairmont Press
Stephen W. Fardo	www.beeindia.in Bureau of Energy Efficiency		

Suggested List of Laboratory Experiments :

- 1 Energy saving by using electronic ballast as compared to conventional choke.*
- 2 Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.*
- 3 Make a survey of 01 establishment to identify different methods used for energy conservation.*

Suggested List of Assignments/Tutorial :

- 1 Ask to search on the website of power ministry and MERC for Electricity act 2003 and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.*
- 2 List energy saving equipments for domestic and commercial applications*
- 3 List the different Name of the Course : ELECTRICAL ENGINEERING GROUP*

6.3 UTILIZATION OF ELECTRICAL ENERGY (UEE)

L T P
5 - 2

RATIONALE

This subject assumes importance in view of the fact that a technician has to work in a wide spectrum of activities wherein he has to make selection from alternative schemes making technical and economical considerations; e.g. to plan and design an electrical layout using basic principles and handbooks, to select equipment, processes and components in different situations. The curriculum has been designed 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 familiarize the students with the new developments in different areas

DETAILED CONTENTS

1. Electric Drives:

- 1.1 Advantages of electric drives
- 1.2 Characteristics of different mechanical loads
- 1.3 Types of motors used as electric drive
- 1.4 Electric braking
 - 1.4.1 Plugging
 - 1.4.2 Rheostatic braking
 - 1.4.3 Regenerative braking
- 1.5 Methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc.
- 1.6 Examples of selection of motors for different types of domestic loads
- 1.7 Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel.

2. Illumination:

- 2.1 Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light
- 2.2 Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux.
- 2.3 Laws of illumination – simple numericals
- 2.4 Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour sodium lamp, fluorescent lamp, halogen lamp, neon lamp.
- 2.5 Calculation of number of light points for interior illumination, calculation of illumination at different points, considerations involved in simple design problems. Illumination schemes; indoor and outdoor illumination levels
- 2.6 Main requirements of proper lighting; absence of glare, contrast and shadow
- 2.7 General ideas about time switches street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.

3. Electric Heating

- 3.1 Advantages of electrical heating
- 3.2 Heating methods:
 - 3.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances, thermostat control circuit
 - 3.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications
 - 3.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace

- 3.2.4 Dielectric heating, applications in various industrial fields
- 3.2.5 Infra-red heating and its applications
- 3.2.6 Microwave heating and its applications
- 3.3 Simple design problems of resistance heating element

4. Electric Welding:

- 4.1 Advantages of electric welding
- 4.2 Welding method
 - 4.2.1 Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment
 - 4.2.2 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method and their applications. Power supply requirement. Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper
- 4.1 Introduction to TIG and MIG welding

5. Electrolytic Processes:

- Need of electro-deposition
- 5.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing
- 5.3 Equipment and accessories for electroplating
- 5.4 Factors affecting electro-deposition
- 5.5 Principle of galvanizing and its applications
- 5.6 Principles of anodizing and its applications
- 5.7 Electroplating of non-conducting materials
- 5.8 Manufacture of chemicals by electrolytic process

6. Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers: (10 hrs)

- 6.1 Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants
- 6.2 Description of Electrical circuit used in
 - a) Refrigerator,
 - b) Air-conditioner, and
 - c) Water cooler

7. Electric Traction:

- 7.1 Advantages of electric traction
- 7.2 Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub-urban, and main line and their speed-time curves
- 7.3 Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector-pentagraph
- 7.4 Factors affecting scheduled speed
- 7.5 Electrical block diagram of an electric locomotive with description of various equipment and accessories used.
- 7.6 Types of motors used for electric traction
- 7.7 Starting and braking of electric locomotives
- 7.8 Introduction to EMU and metro railways

Note: Students should be taken for visits to nearest electrified railway track to study the electric traction system.

Students should be taken for visits of the following during the semester:

List of Practical

1. Study of different types of sources of light, their connections and to measure intensity of light with lux-meter:
 - 1.1 Fluorescent lamp
 - 1.2 HP mercury vapor lamp
 - 1.3 HP sodium vapour lamp
 - 1.4 Compact Fluorescent lamp(CFL)
2. Study of induction furnace by visiting a factory and to prepare a report
3. Study of welding equipment along with its accessories
4. Study of the electroplating plant by visiting an industry and preparing a report
5. Study of the refrigerator/ air conditioner and to prepare a report of its electrical circuit
6. Study of an locomotive by visiting any locomotive repair shop at a nearby station

INSTRUCTIONAL STRATEGY

It is desired to give ample practical examples in the class while teaching this subject. Teacher must supplement his/her classroom teaching with aids such as models, charts, and video films from time to time. This subject requires demonstrations and exposure to actual workplace/industry/field. For this purpose, the subject teacher should do advance planning for visits/studies related to each topic in consultation with HOD and Principal of the polytechnic/institution.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

Sr. No	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Electric Drives	20	25
2	Illumination	10	15
3	Electric Heating	10	15
4	Electric Welding	05	10
5	Electrolytic Processes	05	10
6	Electrical Circuits used in Refrigeration	10	10
7	Electric Traction	10	15
Total		70	100

RECOMMENDED BOOKS

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana
3. Utilization of Electrical Energy by Sahdev, Unique International Publication, Jalandhar
4. A Text Book of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
5. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi
6. Utilization of Electrical Energy by OS Taylor, Pitman Publications
7. Generation, Distribution and Utilization of Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

6.4.1 PLCs AND MICROCONTROLLERS

L T P
4 - 2

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum. Microcontrollers have also assumed great significance in the field of electronics and comma goods industry, and thus considered to be an important field of engineering. This subject aims to expose the students to both of these and give them adequate knowledge of these topics.

DETAILED CONTENTS

1. Introduction to PLC	04 hrs	8Marks
What is PLC, concept of PIC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc.		
2. Working of PLC	08 hrs	16Marks
2.1 Basic operation and principles of PLC		
2.2 Architectural details processor		
2.3 Memory structures, I/O structure		
2.4 Programming terminal, power supply		
3. Instruction Set	06 hrs	10Marks
3.1 Basic instructions like latch, master control self-holding relays.		
3.2 Timer instruction like retentive timers, resetting of timers.		
3.3 Counter instructions like up counter, down counter, resetting of counters.		
3.4 Sequencers, output sequencers, input sequencers, time driven, and event driven sequencers, masking etc.		
3.5 Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal, mask equal limit etc.		
4. Ladder Diagram Programming	04 hrs	8Marks
Programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.		
5. Applications of PLCs	12 hrs	16Marks
5.1 Assembly		
5.2 CNC Machines		
5.3 Packaging		
5.4 Process controls		
5.5 Car parking		
5.6 Doorbell operation		
5.7 Traffic light control		
5.8 Sorting of objects etc		
5.9 Microwave Oven		

5.10 Washing machine

6. Micro Controller Sense (MCS)-51 Over View	8 hrs	16Marks
6.1 Pin details		
6.2 I/o Port structure		
6.3 Memory Organisation		
6.4 Special function registers		
7. Instruction Set Addressing Modes	04 hrs	8Marks
7.1 Timer operation		
7.2 Serial Port operation		
7.3 Interrupts		
8. Assembly language programming	02 hrs	4Marks
8.1 Assemblers and Compilers		
8.2 Assembler Directives		
9. Design and Interface	04 hrs	6Marks
Examples like: keypad interface, 7- segment interface, LCD, stepper motor. A/D, D/A, RTC interface.		
10. Introduction of PIC Micro controllers	02 hrs	4Marks
11. Application of Micro controllers	02 hrs	4Marks

Experiments:

1. Observe various components /parts/symbols/connections of a PLC demonstration kit in your laboratory.
- 2 **Any eight** Application of PLC out of following:-
 - 1 Door bell operation .
 - 2 Traffic light control.
 - 3 Car parking
 - 4 Automatic Star/Delta Starter
 - 5 Microwave Oven
 - 6 Washing machine
 - 7 process control
 - 8 Resistance welding
 - 9 Bottling plant
 - 10 Elevator Simulator
 - 11 Automatic water controller (Reaction vessel)
 - 12 Seven segment display simulator
 - 13 Tank level
- 3 Observe various components /parts/symbols/connections of a 8051 microcontroller Training kit in your laboratory.

RECOMMENDED BOOKS

1. *Programmable Logic Controller* by Job Dan Otter; P.H. International, Inc, USA
2. *Introduction to PLCs* by Gary Dunning. McGraw Hill
3. *Module on PLCs and their Applications* by Rajesh Kumar, NITTTR Chandigarh
4. *Module on “Allen BradlagPIC (SLC 500), Institution set-1*, by Rajesh Kumar, NITTTR, Chandigarh
5. *Module on “PLC Applications based on SLC 5/03”* By Rajesh Kumar, NITTTRChandigarh
6. *The 8051 Micro controller* by I Scot Mackenzie, Prentice Hall International, London
7. *The 8051 Micro controllers Architecture, programming and Applications* by Ayala; Penram International
8. *Process Control Instrumentation Technology* by Johnson, Curits; EE Edition, Prentice Hall of India, New Delhi
9. *Microcontrollers* by Ayala
10. *Microcontrollers* by Mazidi
11. *Microcontrollers* by Neil Makanzie
12. *Microcontrollers* by Deshmukh

6.4.2 INDUSTRIAL AUTOMATION

L T P
4 - 2

Aim:-

1. To explain applications of control systems / Automation
2. Design & program PLC using Ladder logic.
3. To study working of control components

Objective :-

Student will be able to

1. Explain applications of control systems / Automation.
2. Read & design data for control systems.
3. Explain the hydraulic/ pneumatic systems.
4. Describe & program PLC using Ladder logic.
5. Describe working of control components.
6. Draw power & control circuit.

DETAILED CONTENTS

1 Automation	04Hours	08Marks
1.1 Need of automation		
1.2 Advantages of automation		
1.3 Requirements of automation		
2 Control System	06Hours	10Marks
2.1 Concept of control system		
2.2 Basic block diagram of control system		
2.3 Transfer function		
2.4 Different terms in control system		
2.5 Types of control system		
2.6 Applications of control system		
2.7 Development of block diagram for simple applications like level, Temperature, flow control		
3 Control System Components	12Hours	16Marks
3.1 Contacts-types, current capacity & load utilization categories		
3.2 Solenoids-dc, ac		
3.3 I/P devices- switches-push buttons, foot switch, selector switch, pilot Switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing		
3.4 Relays- electromechanical, reed		
3.5 O/P devices- contactors, valves, pilot lamps		
3.6 Symbols in power & control circuits		
3.7 Developing control circuit-basic & thumb rule		
3.8 Power & control circuit for different applications like hoist, crane, conveyer belt, induction motors		
4 Electrical Actuators	08Hours	15Marks
4.1 Potentiometers-working & use as error detector		
4.2 Servomotors-ac & dc –working principle		
4.3 Synchros - transmitter, control transformer, use of as error detector		
4.4 Stepper motor-PM & variable reluctance- working principle		
4.5 Tacho - generator		
4.6 Applications of above components as AC/DC control system.		

5 Controllers	08Hours	15Marks
5.1 Hydraulic-advantages & disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals		
5.2 Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic & hydraulic systems		
5.3 Electrical & electronic controller-brief overview of op-amps, inverting, non-inverting, lead-lag networks		
5.4 Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller		

6 Control actions	06Hours	12Marks
6.1 On-Off, P, I, P+I, P+D,P+I+D, actions		
6.2 P+I+D action using hydraulic, pneumatic electronic controller		
6.3 Tuning of P+I+D controller		

7 Programmable Logic Controller	08Hours	10Marks
7.1 Introduction		
7.2 Advantages & disadvantages		
7.3 PLC Vs PC		
7.4 Block diagram of PLC		
7.5 Basic blocks like CPU, I/O modules, bus system, power supplies& remote I/Os		
7.6 Different PLCs available in market		

8 Programming of PLC	02Hours	10Marks
8.1 development of Ladder logic		
8.2 some simple programs such as I/O connections, starting of IM, stepper motor control (treatment to topic no.8.2 should be given at the time of practical / pp hours.)		

9 Introduction to special control systems	02Hours	04Marks
9.1 Distributed Control System(DCS)-brief introduction to hardware & software used		
9.2 SCADA- brief introduction to hardware & software used		

Practical:

Intellectual Skills:

- a. Logical development
- b. Programming skills

Motor Skills :

- a. Interpretation skills
- b. Connecting properly

List of Practicals:

- 1) a) To plot the characteristics of potentiometer
b) Use of potentiometer as error detector
- 2) To plot V-I characteristics of DC & AC servomotors. compare them with DC & AC motor characteristics
- 3) a) To plot the characteristics of synchro transmitter
b) Use of synchro transmitter- control transformer pair as error detector.
- 4) Measure step angle for a stepper motor in forward & reverse direction.
- 5) Draw a power circuit & control circuit using control symbols for a 3-phase IM using DOL starter.
- 6) Observe various components /parts/symbols/connections of a PLC demonstration kit in your laboratory.
- 7) Draw a ladder logic diagram for two different examples.

- 8) *By using above ladder logic diagram observe the status of I/Os using PLC.*
 9) *Perform stepper motor/ temperature control using PLC.*
 10) *Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.by lamp manufacturing industry equipments used in energy auditing*

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Nagrath Gopal	Control System Engg.		Wiley Eastern
K.Ogata	Modern Control Engg.		Prentice Hall
Jacob	Industrial Control Engg		Prentice Hall
Andrew Parr	Hydraulics & Pneumatics		Jaico Publication
Webb & Reis	Programmable Logic Controller: Principle Applications		Wiley Eastern
S.K. Bhattachrya	Control of Electrical Machines		New Age International Publishers
Brijinder Singh			

Reference books :

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Jon stenerson	Industrial automation and process control		Prentice Hall
Richad Shell	Handbook of Industrial Automation		Taylor and Francis

Suggested List of Laboratory Experiments :

- 1 a) To plot the characteristics of potentiometer*
- b) Use of potentiometer as error detector*
- 2 To plot V-I characteristics of DC & AC servomotors. compare themwith DC & AC motor characteristics*
- 3 Observe various components /parts/symbols/connections of a PLC demonstration kit in your laboratory.*

Suggested List of Assignments/Tutorial :

- 1 Collect the data of various PLC brands market & list.
- 2 Collect the data from internet about hardware & software of new control systems like SCADA, DCS
- 3 Explain the various control components in your laboratory to built a AC/DC position control System

6.4.3 TESTING & MAINTENANCE OF ELECTRICAL MACHINES

L T P
4 - 2

Aim :-

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

Objective :-

Student will be able to

1. *Know safety measures & state safety precautions.*
2. *Test single phase, three phase transformer, DC & AC machine as per IS.*
3. *Identify / Locate common troubles in electrical machines & switch gear.*
4. *Plan & carry out routine & preventive maintenance.*
5. *Install LV switchgear & maintain it.*
6. *Ascertain the condition of insulation & varnishing if necessary.*
7. *Initiate total productive maintenance.*

DETAILED CONTENTS

1. Safety & Prevention of Accidents: **06Hours 10Marks**

Definition of terminology used in safety; safety, hazard, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don'ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

02. General Introduction: **10Hours 15Marks**

Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests. Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.

03. Testing & maintenance of rotating machines: **08Hours 15Marks**

Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992 Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968 Brake test on DC Series motor.

04. Testing & maintenance of Transformers: 12Hours 24Marks

Listing type test, routine test & special test as per I.S. 2026-1981 Procedure for conducting following tests: Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta –delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028(part III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical)

05. Testing & maintenance of Insulation: 08Hours 15Marks

Classification of insulating materials as per I.S. 8504(part III)1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot. Properties of good transformer oil, list the agents which contaminates the insulating oil, understand the procedure of following tests on oil as per I.S. 1692-1978a) acidity test b) sludge test c) crackle test e) flash point test. Filtration of insulating oil protection of electrical equipments (insulation) during the period of inactivity. Methods of cleaning the insulation covered with loose, dry dust, sticky dirt, & oily viscous films, procedure for cleaning washing & drying of insulation & revarnishing Methods of internal heating & vacuum impregnation.

06. Trouble shooting of Electrical Machines & Switch gear: 08Hours 15Marks

Significance of trouble shooting of various electrical machines and describes the procedure for the same. Internal and external causes of failure of equipment. Various types of faults (mechanical, electrical & magnetic) in electrical machines reason for their occurrence, use of following tools: Bearing puller, Filler gauge, dial indicator, spirit level megger, earth tester, growler, multimeter, Trouble shooting charts for 1 & 3-phase induction motor, 1 & 3- phase transformer. List the common troubles in electrical installation & cables Maintenance & trouble shooting of LV switchgear like MCCB, ELCB, contactors & batteries.

07. Installation: 04Hours 06Marks

Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.

Practical:

Skills to be developed:

Intellectual skills:

1. Select appropriate meters & equipment
2. Recollect Testing & Maintenance procedures.

Motor Skills:

1. Accuracy of Measurement
2. Proper connections
3. Draw characteristics

List of Practical:

- 1) Draw circuit diagram select appropriate meters, connect it to perform routine test on single phase Induction motor
- 2) As per the given circuit diagram perform routine test on three phase Induction motor, & calculate the different parameters
- 3) Select two single phase transformers, perform polarity test, mark its terminals, select appropriate meters & perform back to back test, compare its regulation with direct loading method
- 4) Perform parallel operation of transformer as per I.S.
- 5) Perform parallel operation of alternator as per I.S.
- 6) Carry out OC & SC test on Induction motor, plot circle diagram, & calculate parameters
- 7) Perform brake test on DC series motor & plot characteristic of output against torque, speed, load current as per I. S. list suitable applications.
- B) Field work:
 - 8) Observe & carry out weekly, monthly & yearly maintenance of motor in your workshop & prepare its report
- C) Mini project:
 - 9) Prepare trouble-shooting chart for single and three phase transformers
 - 10) Prepare trouble-shooting chart for single and three phase motors

Text Books:**Name of Authors**

B. L. Theraja

B. V. S. Rao

C.J. Hubert

Titles of the Book

Electrical Technology Vol I To IV

Operation & Maintenance
Of Electrical Machines Vol – I & II

Preventive Maintenance

Name of the Publisher

Chand & Co New Delhi

Media Promoters & Publisher ,
Mumbai

Hand Books & Journals

6.5 MAJOR PROJECT

L T P
- - 10

Project work aims at developing skills in the students whereby they apply in totality the knowledge and skills gained through the course in the solution of a practical problem undertaken as a project work. The students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or be given project assignment at least two to three months in advance. The project work identified in collaboration with industry/field organization should be preferred.

Each teacher is expected to guide the project work of 5-6 students at a time. The project assignments may consist of :

- a) Projects related with repair and maintenance of machine parts
- b) Estimating and costing projects
- c) Design of components/ parts/ jigs / fixtures
- d) Projects related to quality control
- e) Project work related to increasing productivity
- f) Project connected with work study
- g) Projects relating to erection, installation, calibration and testing
- g) Projects related to wastage reduction
- h) Projects related to energy audit

For Students of Electrical Engineering Diploma Programme the project work can be grouped under the following four groups. A number of projects have been mentioned under each section. A student should take at least two projects both of which should not be from the same group. If more than two projects are taken to make up a total of 256 hours, then more than 1 may be taken from the same group as long as at least two groups are covered. A student is read to choose one project from each section.

Report for all the four project should be prepared and and will give a seminar. The same will be assessed for internal and external assessment.

NOTE: Any one from each section

SECTION A

1.1 Electrical Machines and Equipment:

- 1.1 Design and Construction of a small transformer (100 VA to 1 kVA)
- 1.2 Construction of phase sequence indicator
- 1.3 Construction of hot air drier
- 1.4 Construction of a Simple loop generator
- 1.5 Design and fabrication of Automatic curtain operator
- 1.6 Construction of Automatic Star-Delta starter
- 1.7 Construction of Automatic Water level controller
- 1.8 Balancing of load of an indoor distribution transformer
- 1.9 Construction of Choke for fluorescent tubes
- 1.10 Design and construction of fan regulators (inductance type)
- 1.11 Design and construction of fan regulators (Resistance type)
- 1.12 Design and construction of loading rheostats

- 1.13 Design and construction of Desert coolers
- 1.14 Fabrication of electric motor (FKW)
- 1.15 Rewinding of motors upto 5 HP
- 1.16 Design and construction of Geyser
- 1.17 Electroplating of small domestic gadgets
- 1.18 Erection/installation and commissioning of rotating electrical machine
- 1.19 Fault detection and repair of electrical/electronic instruments
- 1.20 Design and assembly of contactor control circuit for various applications

SECTION B

1.2 Electrical Power:

- 1.2.1 Drawing, estimating and costing of electrical installation of the institution from supplier's pole to the institution distribution board. Drawing, estimating and costing of electrical installation of a workshop having a given number of electrically operated appliances/machines.
- 1.2.2 To study the laying of underground distribution cable for a small colony starting from main distribution pole
- 1.2.3 To study the erection erect a 5 pole span overhead line for a small distance for distribution of electrical energy. To energize it and prepare list of material and cost estimates.
- 1.2.4 To provide a service connection to a consumer's premises for domestic purposes
- 1.2.5 To survey the load of given area in a village, small colony, calculate the effective load and find out the sizes of the cables/conductors for the proposed distribution system
- 1.2.6 Designing of light and fan scheme for a institutional or commercial building
- 1.2.7 To study the augmentation of a nearby pole mounted sub station

SECTION C

1.3 Electronic Based Projects:

Fabrication of:

- 1.3.1 Voltage Stabilizer for refrigerator, air-conditioner
- 1.3.2 Emergency light using SCR
- 1.3.3 Power amplifier
- 1.3.4 Low cost intercom for home
- 1.3.5 Analog computer
- 1.3.6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906
- 1.3.7 Automatic battery charger using SCR
- 1.3.8 Battery operated tube light
- 1.3.9 Solid state fan regulator
- 1.3.10 Burglar Alarm
- 1.3.11 Hearing aid
- 1.3.12 Automatic street light/dressing table light
- 1.3.13 Mosquito Repeller
- 1.3.14 Inverter circuit 500 watt.
- 1.3.15 Solid State Control of Traffic Lights

SECTION D

1.4 Fabrication and Testing of:

- 1.4.1 Inverter/Emergency light circuit using power transistors
- 1.4.2 SCR based automatic battery charger
- 1.4.3 SCR operated illumination controller
- 1.4.4 SCR operated automatic water level controller
- 1.4.5 SCR based speed controller for DC shunt motor
- 1.4.6 Three phase full wave rectifier using power diodes
- 1.4.7 Timer circuit using 555-IC
- 1.4.8 SCR controlled rectifier circuit
- 1.4.9 Speed control circuit of DC shunt motor using SCR
- 1.4.10 Inverting and non-inverting amplifiers using OP AMP(741)
- 1.4.11 Comparator circuits using OP AMP (741)

Note: *The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students*

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No	Performance criteria	Max. marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10	10	8	6	4	2
2.	Planning and execution of considerations	10	10	8	6	4	2
3.	Quality of performance	20	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self - expression/communication skills	5	5	4	3	2	1
7.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
Total marks		100	100	80	60	40	20

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluated before being disqualified and declared "not eligible to receive diploma". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.
4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve another criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project items prepared by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.

6.6 PRACTICES IN COMMUNICATION SKILLS

L T P
- - 2

RATIONALE

For successful completion of diploma programme, the students should possess adequate command on language and communication skills so that they are able to express themselves with ease and felicity. The language used by the students should be appropriate to objectives and occasion. The contents of this subject shall provide them practical training through language laboratory.

LIST OF PRACTICAL EXERCISES

1. Exercises on phonetics
2. Group Discussion
3. Exercises on self-assessment using tools like SWOT analysis.
4. Internet communication
5. Correspondence
 - 5.1 Resume writing
 - 5.2 Covering letter
 - 5.3 Follow-up correspondence
 - 5.4 Business Correspondence
6. Practice on listening skills.
7. Speaking exercises with emphasis on voice modulation (reading and extempore)
8. Demonstration and practice on Body language and Dress sense.
9. Exercises on etiquettes and mannerism in difficult situations like business meetings, table manners, telephone etiquette and manners related to opposite gender.
10. Mock interviews (telephonic/personal)
11. Cross-cultural Communication
12. Role play for effective Communication.
13. Exercises on wit and humour in conversations and creating lively environment.