4.1 ELECTRICAL MACHINES - I

L	T	P
4	-	3

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 diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Operate and maintain D.C. Generator
- Operate and maintain D.C. shunt, series and compound motors
- Execute speed control on D.C. Motors
- Select which type of D.C. motor suits a particular job
- Connect and use single phase transformer
- Operate auto transformers
- Conduct open CKT and short CKT tests on a single phase transformer
- Test polarity of windings of a three phase transformer and connect windings in various configurations
- Operate and maintain three phase transformers

DETAILED CONTENTS

1. Introduction to Electrical Machines (06 Periods)

    1.1 Definition of motor and generator
    1.2 Torque development due to alignment of two fields and the concept of torque angle
    1.3 Electro-magnetically induced emf
    1.4 Elementary concept of an electrical machine
    1.5 Comparison of generator and motor
    1.6 Generalised theory of electrical machines

2. DC Machines (22 Periods)

    2.1 Main constructional features, Types of armature winding
    2.2 Function of the commutator for motoring and generation action
    2.3 Factors determining induced emf
    2.4 Factors determining the electromagnetic torque
    2.5 Various types of DC generators

2.6 Significance of back e.m.f., the relation between back emf and Terminal voltage
2.7 Armature Reaction
2.8 Methods to improve commutation
2.9 Performance and characteristics of different types of DC motors
2.10 Speed control of dc shunt/series motors
2.11 Need of starter, three point dc shunt motor starter and 4 point starter
2.12 Electric Braking
2.13 Applications of DC motors
2.14 Faults in dc machines and their retrospective
2.15 Losses in a DC machine
2.16 Determination of losses by Swinburne's test
2.17 Rating and Specifications of DC machines

3. Single Phase Transformer (22 Periods)

3.1 Introduction
3.2 Constructional features of a transformer and parts of transformer
3.3 Working principle of a transformer
3.4 EMF equation
3.5 Transformer on no-load and its phasor diagram
3.6 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
3.7 Mutual and leakage fluxes, leakage reactance
3.8 Transformer on load, voltage drops and its phasor diagram
3.9 Equivalent circuit diagram
3.10 Relation between induced emf and terminal voltage, voltage regulation of a transformer- mathematical relation
3.11 Losses in a transformer
3.12 Open circuit and short circuit test. Calculation of efficiency, condition for maximum efficiency-maintenance of Transformer, scheduled Maintenance
3.13 Auto transformer construction, working and applications
3.14 Different types of transformers including dry type transformer.
3.15 Rating and Specifications of single phase transformer

4. Three Phase Transformer (14 Periods)

4.1 Construction of three phase transformers and accessories of transformers such as Conservator, breather, Buchholtz Relay, Tap Changer (off load and on load) (Brief idea)
4.2 Types of three phase transformer i.e. delta-delta, delta-star, star-delta and star-star
4.3 Star delta connections (relationship between phase and line voltage, phase and line current)
4.4 Conditions for parallel operation (only conditions are to be studied)
4.5 On load tap changer

4.6 Difference between power and distribution transformer
4.7 Cooling of transformer
4.8 Rating and Specifications of three phase transformers

LIST OF PRACTICALS

1. To measure the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase-winding in sequence

   OR

   Measurement of the angular displacement of the rotor of a slip-ring induction motor on application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding

2. Speed control of DC shunt motor (i) Armature control method (ii) Field control method

3. Study of DC series motor with starter (to operate the motor on no load for a moment)

4. Determine efficiency of DC motor by Swinburne's Test at (i) rated capacity (ii) half full load

5. To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load

6. To find the efficiency and regulation of single phase transformer by actually loading it.

7. Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations

8. Finding the voltage and current relationships of primary and secondary of a three phase transformer under balanced load in various configurations conditions such as
   (a) Star-star
   (b) Star-delta
   (c) Delta-star
   (d) Delta - Delta configuring conditions.

INSTRUCTIONAL STRATEGY

Electrical machines being a core subject of electrical diploma curriculum, where a student will deal with various types of electrical machines which are employed in industry, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Special care has to be taken on conceptual understanding of concepts and principles in the subject. For this purpose exposure to industry, work places, and utilization of various types of electrical machine for different applications may be emphasized. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, Education Pvt Ltd. New Delhi
2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi
5. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	06	10
2.	22	35
3.	22	35
4.	14	20
Total	**64**	**100**

4.2 ELECTRICAL MEASURING INSTRUMENTS AND INSTRUMENTATION

L	T	P
4	-	3

RATIONALE

Diploma holders in Electrical Engineering have to work on various jobs in the field as well as in testing laboratories and on control panels, where be performs the duties of installation, operation, maintenance and testing by measuring instruments. Persons working on control panels in power plants, substations and in industries, will come across the use of various types of instruments and have to take measurements.

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

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Connect and repair different indicating and recording instruments in electric circuits
- Measure different electrical quantities like current, voltage, power, energy, power factor, frequency etc.
- Select the type and range of instruments to be used for the job
- Operate CT (Current Transformer) and PT (Potential Transformer) for measurement
- Select and use suitable sensors for measurements of different non-electrical quantities
- Use instruments for measuring different electrical quantities
- Use sensors for measuring non electrical quantities

DETAILED CONTENTS

1. Introduction to Electrical Measuring Instruments: (10 Periods)

    1.1 Concept of measurement and instruments
    1.2 Concept of measurement of electrical quantities and instruments for their measurements, sources of error.
    1.3 Types of electrical measuring instruments – indicating, integrating and recording type instruments

1.4 Essentials of indicating instruments – deflecting, controlling and damping torque

2. Ammeters and Voltmeters (Moving coil and moving iron type): (08 Periods)

2.1 Concept of ammeter and voltmeters and difference between them
2.2 Construction and working principles of moving Iron and moving coil instruments
2.3 Merits and demerits, sources of error and application of these instruments

3. Wattmeters (Dynamometer Type) (04 Periods)

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

4. Energymeter (06 Periods)

a) Induction Type

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

4.1 Errors and their compensation
4.2 Simple numerical problems
4.3 Construction and working principle of maximum demand indicators

b) Digital energy meter (diagram, construction and application)

5. Miscellaneous Measuring Instruments: (12 Periods)

5.1 Construction, working principle and application of Meggar, Earth tester(analog and digital) Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter)
5.2 Instrument Transformers: Construction, working and applications
a) CT
b) PT

6. Electronic Instruments: (06 Periods)

6.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO and its various controls. Applications of CRO.
6.2 Digital multi-meter (only block diagram) and Applications

7. LCR meters. (04 Periods)
Study of LCR meters and their applications

8. Power Measurements in 3-phase circuits by (06 Periods)

   a) Two wattmeter method in balanced and unbalanced circuits and simple problems
   b) Three wattmeter method

9. Transducers :- (04 Periods)

   Introduction, Types of Transducers (1 phase,3 phase)

   Basic concept of pressure measurement, flow measurement, level measurement, displacement measurement using transducers

10. Measurement of Temperature (04 Periods)

    Different types of thermometers, thermocouple, resistance temperature detector and their construction, principle and working. Thermal Imager Camera (Concept)

LIST OF PRACTICALS

1. Use of analog and digital multimeter for measurement of voltage, current (A.C/D.C) and resistance
2. Measurement of pressure by using LVDT
3. To measure the value of earth resistance using earth tester.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
5. Measurement of power and power factor of a three-phase balanced load by two wattmeter method.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.
7. Measurement of power in a 3 phase circuit using CT, PT and 3-phase wattmeter.
8. Use of LCR meter for measuring inductance, capacitance and resistance.
9. To record all electrical quantities from the meters installed in the institution premises.
10. To measure Energy at different Loads using Single Phase Digital Energy meter
11. Measurement of temperature by using thermister/Thermal Imager
12. Calibration of single phase and three-phase energy meter

INSTRUCTIONAL STRATEGY

After making the students familiar with measuring instruments, they should be made conceptually clear about the constructional features and make them confident in making connection of various measuring instruments. Teacher should demonstrate the application

of each measuring instrument in laboratory and encourage students to use them independently.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

1. Electrical Measurements and Measuring Instruments by Golding and Widdis; Wheeler Publishing House, New Delhi
2. Electrical Measurements and Measuring Instruments by SK Sahdev, Uneek International Publications, Jalandhar
3. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
4. Electric Instruments by D. Cooper
5. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
6. Electronics Instrumentation by Umesh Sinha, Satya Publication, New Delhi
7. Basic Electrical Measurements by Melville B. Staut.
8. Electrical Measurement and Measuring Instruments by JB Gupta, SK Kataria and Sons, New Delhi
9. Electrical Measurement and Measuring Instruments by ML Anand, SK Kataria and Sons, New Delhi
10. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	10	15
2	08	15
3	04	05
4	06	10
5	12	20
6	06	10
7	04	05
8	06	10
9	04	05
10	04	05
Total	**64**	**100**

4.3 UTILIZATION OF ELECTRICAL ENERGY

L	T	P
4	-	-

RATIONALE

This subject assumes importance in view of the fact that an electrical 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 contents have 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

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Design lighting scheme for domestic, industrial and commercial installation
- Design and select a suitable heating arrangement for a particular job
- Handle and maintain electric welding equipment
- Handle and maintain electrolytic plant
- Find faults in electric circuits of refrigerators
- Suggest electric drives as per need
- Maintain electric traction lines and track

DETAILED CONTENTS

1. Electric Heating (12 Periods)

    1.1 Advantages of electrical heating
    1.2 Heating methods:
        1.2.1 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
        1.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications
        1.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace
        1.2.4 Dielectric heating, applications in various industrial fields

1.2.5. Infra-red heating and its applications (construction and working of two appliances)
1.2.6. Microwave heating and its applications (construction and working of two appliances)
1.2.7 Solar Heating

1.3 Calculation of resistance heating elements (simple problems)

2. Electric Welding: (06 Periods)

2.1 Advantages of electric welding
2.2 Welding methods
2.2.1. Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment
2.2.2 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

3. Electrolytic Processes: (12 Periods)

3.1 Need of electro-deposition
3.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing
3.3. Equipment and accessories for electroplating
3.4. Factors affecting electro-deposition
3.5. Principle of galvanizing and its applications
3.6 Principles of anodizing and its applications
3.7 Electroplating of non-conducting materials
3.8 Manufacture of chemicals by electrolytic process

4. Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers: (08 Periods)

4.1 Principle of air conditioning
4.2 Description of Electrical circuit used in
a) Refrigerator,
b) Air-conditioner, and
c) Water cooler

5. Electric Drives: (16 Periods)
5.1 Advantages of electric drives
5.2. Characteristics of different mechanical loads
5.3. Types of motors used as electric drive

5.4. General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc.
5.5 Examples of selection of motors for different types of domestic loads
5.6 Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel.
5.7 Selection of motors for Domestic Appliances

6. Electric Traction: (14 Periods)

6.1 Advantages of electric traction
6.2 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
6.3 Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector-pentagraph
6.4 Factors affecting scheduled speed
6.5. Electrical block diagram of an electric locomotive with description of various equipment and accessories used.
6.6 Types of motors used for electric traction
6.7 Power supply arrangements
6.8 Starting and braking of electric locomotives
6.9 Introduction to EMU and metro railways
6.10 Train Lighting Scheme

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

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce
- Software installation, operation, development

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, Uneek 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 D.R. Arora, North Publication, Jalandhar
7. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	12	19
2	06	09
3	12	19
4	08	12
5	12	19
6	14	22
Total	**64**	**100**

4.4 DIGITAL ELECTRONICS

L	T	P
4	-	3

RATIONALE

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belongs to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Add, multiply, subtract binary to hexadecimal number system
- Use 1's and 2's compliment method for addition and substraction
- Draw the symbols of various gates and write the truth tables for those gates
- Use boolean laws for the simplification of logical expressions
- Use the de-morgan's theorem for simplification
- Apply K-map technique for simplifications
- Apply half adder, full adder, encoder, decoder, multiplexer and demultiplexer
- Use various flip-flops in digital circuits
- Use converted from A/D and D/A conversions
- Use various types of numbers in digital circuits

DETAILED CONTENTS

(Part-A)

1. Number Systems (10 Periods)

   1.1 Decimal, binary, octal and hexa-decimal number systems and their inter-conversion
   1.2 Binary and Hexadecimal addition, subtraction and multiplication
   1.3 1's and 2's complement methods of addition/subtraction

2. Gates (07 Periods)

   Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR and equivalence circuit (Ex.NOR)

3. Boolean Algebra (10 Periods)

3.1 Boolean Relations and their applications
3.2 DeMorgan's Theorems
3.3 K-Map upto four variables

4. Combinational Circuits (10 Periods)

4.1 Half adder, Full adder
4.2 Encoder, Decoder
4.3 Multiplexer/Demultiplexer
4.4 Display Devices (LED, LCD and 7-segment display)

5. Flip-Flops (08 Periods)

5.1 J-K Flip-Flop
5.2 R-S Flip-Flop
5.3 D-Type Flip-Flop
5.4 T-Type Flip-Flop
5.5 Applications of Flip-Flops

6. Introduction of Shift Registers and Counters (08Periods)

7. A/D and D/A Converters (06 Periods)

7.1 A/D converter (Counter ramp, successive approximation method of A/D Conversion)
7.2 D/A converters (Binary weighted, R-2R D/A Converter)

8. Semi-conductor Memories (05 Periods)

Types, merits, demerits, and applications

LIST OF PRACTICALS

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates
2. Construction of Half Adder using gates
3. Construction of Full Adder using gates
4. To verify the truth table for JK flipflop
5. Construction and testing of any counter
6. Verification of operation of a 8-bit D/A Converter

INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A converters

and other Topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini projects based on microprocessor operations may be identified and given to students as assignments.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain, Tata McGraw Hill, Education Pvt. Ltd. New Delhi
2. Digital Principles and Electronics by Malvino and Leach, Tata McGraw Hill, New Delhi
3. Digital Electronics by Rajiv Sapra, Eshan Publications, Ambala City
4. Digital Fundamentals by Floyd and Jain , Pearsons Education (Singapore) Pte Ltd Patparganj, Delhi 110092
5. Digital Electronics by Jamwal, Dhanpat Rai and Co. New Delhi
6. Microprocessors Architecture, Programming and Application with 8085/8080A, Ramesh S Gaonkar, Wiley Eastern Ltd. New Delhi
7. Introduction to Microporcessors by Aditya Mathur, TMH Publishing Co., New Delhi
8. Microprocessors and Microcontrollers by BP Singh, Galgotia Publications, New Delhi
9. Digital Systems by Sanjay K Bose, Wiley Eatern(P) Ltd. New Delhi
10. Digital Systems : principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
11. Digital Integrated Circuits by AK Gautam, SK Kataria and Sons, New Delhi
12. Microprocessors(The 8086 and 8088) by AK Gautam and A Jaiswal; SK Kataria and Sons, New Delhi
13. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in
www.nitttrchd.ac.in.> nctel

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	16
2.	07	10
3.	10	16
4.	10	16
5.	08	12
6.	08	12
7.	06	10
8.	05	08
Total	**64**	**100**

4.5 ELECTRICAL ENGINEERING DESIGN AND DRAWING - II

L	T	P
-	-	6

RATIONALE

A diploma holer in Electrical Engineering is supposed to have ability to :

i) Read, understand and interpret electrical engineering drawings
ii) Communicate and correlate through sketches and drawings
iii) Prepare working drawings of electrical circuits, motor control, earthing and motor parts

The contents of this subject has been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- recognize contactor and its use in various applications of 3 phase induction motor
- recognize different types of earthing
- tell about relevant IS specification for earthing
- read and interpret key diagrams
- read and interpret schematic and wiring diagrams

DETAILED CONTENTS

1 Contractor Control Circuits (48 periods)

Design of circuit drawing of schematic diagram and power wiring diagram of following circuits, specification of contactors

1.1 DOL starting of 3-phase induction motor

1.2 3-phase induction motor getting supply from selected feeder

1.3 Forwarding/reversing of a 3-phase induction motor

1.4 Two speed control of 3-phase induction motor

1.5 Limit switch control of a 3-phase induction motor

1.6 Sequential operating of two motors using time delay relay

1.7 Manually generated star delta starter for 3-phase induction motor

1.8 Automatic star delta starter for 3-phase Induction Motor

2. Earthing (30 periods)

2.1 Concept and purpose of earthing

2.2 Different types of earthing, drawings of plate and pipe earthing

2.3 Procedure of earthing, test of materials required and costing

2.4 Method of reducing earth resistance

2.5 Relevant IS specifications of earth electrode for earthing a transformer, a high building

2.6 Earthing layout of distribution transformer

2.7 Substation earthing layout and earthing materials

2.8 Key diagram of 11kV, 33kV, 66kV, 132 kV sub-stations

3. Schematic Diagram of lighting system of conference room/Theatre/sports stadium (indoor and outdoor) and Circuits using timers using CAD and , Drawing sheets. (18 periods)

Note: Draw various schematic and wiring diagrams using graphic package(preferably CAD)

MEANS OF ASSESSMENT

- Design and drawing
- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

RECOMMENDED BOOKS

1. Electrical Design and Drawings by Raina & Bhattacharya

2. Electrical Design & Drawings by Sarabjeet Singh

3. IEEE Guide 80 for Earthing, IEEE Publication, New York

4. Electrical Design and Drawing by Surjit Singh, North Publication, Jalandhar

5. BIS for Electrical Earthing

6 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

4.6 ELECTRICAL WORKSHOP PRACTICE – II

L	T	P
-	-	6

RATIONALE

An electrical diploma holder will be required to inspect, test and modify the work done by skilled workers or artisans working under him. In addition to these persons, many a times, it will become necessary for him to demonstrate the correct method and procedure of doing a job. In order to carry out this function effectively in addition to conceptual understanding of the method or procedure he must possess appropriate manual skills. The subject aims at developing special skills required for repairing, faultfinding, wiring in electrical appliances and installations.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Carryout pipe and plate earthing and
- Provide connection to 3-ϕ motors through various starters
- Detect and rectify various types of faults in contactor control circuits
- Rewind a single phase motor or choke coil
- Make cable joints and lay underground cables at the work site
- Make connections of star-delta transformers and D.O.L. starters
- Repair and maintain electrical wiring and appliances
- Design a small PCB for small electrical circuit

DETAILED CONTENTS

PRACTICAL EXERCISES:

1. To carry out pipe/plate earthing for a small house and 3-phase induction motor. Testing the earthing using earth tester

2. Connections of single phase and 3-phase motors, through an appropriate starter and to change their direction of rotation

3. Wiring, testing and fault finding of the following contactor control circuits operating on 3-phase supply:

    a) Remote control circuits
    b) Time delay circuits
    c) Inter locking circuits
    d) Sequential operation control circuits

    Note: Students may be asked to study control circuit of a passenger lift, automatic milling machine, etc. using relays

4. Winding/re-winding of a fan (ceiling and table)/ motor
5. Power cable jointing using epoxy based jointing kits

6. Demonstration of laying of underground cables at worksite

7. Dismantling/assembly of star-delta and DOL starter

8. Dismantling and assembly of voltage stabilizers

9. Repair and maintenance of domestic electric appliances, i.e. electric iron, geyser, fan, heat convector, desert cooler, room heater, electric kettle, electric oven, electric furnace etc.

10. Dismantling/assembly/maintenance of motor operated appliances such as mixer, blender, drill machine etc.

11. Design a printed circuit Board (PCB) for voltage regulator using zener diode.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

4.7 SOFT SKILLS – II

L	T	P
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RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Develop Communication Skills
- Work in a team
- Learn to resolve conflict by appropriate method
- Identify leadership traits and learn self motivation
- Follow ethics

DETAILED CONTENTS

- Concept of team building, behavior in a team
- Developing Interpersonal Relations- empathy, sympathy
- Communication skills-improving non-verbal communication
- Conflict Management
- Motivation
- Leadership
- Professional Ethics and Values
- Health, Hygiene, Cleanliness and Safety

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Camp – Environment awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.