4.1 ELECTRICAL MACHINES - I

L	T	P
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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 OUTCOME

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 hrs)

    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 hrs)

    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 Significance of types of machines

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 Applications of DC motors
2.13 Faults in dc machines and their retrospective
2.14 Losses in a DC machine
2.15 Determination of losses by Swinburne's test

3. Transformers (single phase) (22 hrs)

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
3.10 Relation between induced emf and terminal 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.

4. Transformers three phase (14 hrs)

4.1 Construction of three phase transformers and accessories of transformers such as Conservator, breather, Buchholtg 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

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.

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 Fitzgerald
6. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	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 OUTCOME

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 hrs)

    1.1 Concept of measurement and instruments
    1.2 Concept of measurement of electrical quantities and instruments for their measurements
    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 hrs)

2.1 Concept of ammeters 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 hrs)

Construction, working principle, merits and demerits of dynamometer type wattmeter, sources of error

4. Energymeter (06 hrs)

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 diagram of digital type energy meter

5. Miscellaneous Measuring Instruments: (12 hrs)

5.1 Construction, working principle and application of Meggar, Earth tester, 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 and their ratio and phase angle error

6. Electronic Instruments: (06 hrs)

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 hrs)

Study of LCR meters and their applications

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

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

9. Measurement of Non-electrical Quantities (Introduction only) (04 hrs)

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

10. Measurement of Temperature (04 hrs)

    Different types of thermometers, thermocouple, resistance temperature detector and their construction, principle and working.

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

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.

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

SUGGESTED DISTRIBUTION OF MARKS

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

4.3 INDUSTRIAL ELECTRONICS AND CONTROL OF DRIVES

L	T	P
4	-	3

RATIONALE

Industrial electronics plays a very vital role in the field of control engineering specifically in the modern industries as they mostly use electronic controls, which are more efficient, effective and precise as compare to the conventional methods. The old magnetic and electrical control schemes have all become obsolete. Electrical diploma holder many times has to maintain the panels used in the modern control process. Therefore, the knowledge of components like thyristors and other semiconductor devices used in such control panels is must for them in order to supervise the work efficiently and effectively. Looking in to usefulness and importance of the subject this has been incorporated in the curriculum.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Use SCR, TRIAC and Diac as per requirement of circuit
- Control fan speed using Triac Quadriac
- Control speed of D.C. shunt motor or universal motor
- Demonstrate the output wave shape on CRO
- Repair UPS and storage batteries
- Maintain panels used in the modern control process

DETAILED CONTENTS

1. Introduction to SCR (16 hrs**)**

   1.1. Construction and working principles of an SCR, two transistor analogy and characteristics of SCR
   1.2. SCR specifications and rating
   1.3. Construction, working principles and V-I characteristics of DIAC, TRIAC and Quadriac
   1.4. Basic idea about the selection of heat sinks for SCR and TRIACS
   1.5. Methods of triggering a Thyristor. Study of triggering circuits
   1.6. UJT, its Construction, working principles and V-I characteristics, UJT relaxation oscillator
   1.7. Commutation of Thyristors
   1.8. Series and parallel operation of Thyristors
   1.9. Applications of SCR, TRIACS and Quadriac such as light intensity control, speed control of DC and universal motor, fan regulator, battery charger etc.
   1.10. dv/dt and di/dt protection of SCR.

2. Controlled Rectifiers (10 hrs)

2.1 Single phase half wave controlled rectifier with resistive load and inductive load, concept of free wheeling diode.
2.2 Single phase half controlled full wave rectifier
2.3 Single phase fully controlled full wave rectifier bridge.
2.4 Single phase full wave centre tapped rectifier
2.5 Three phase full wave half controlled bridge rectifier
2.6 Three phase full wave fully controlled bridge rectifier

3. Inverters, Choppers, Dual Converters and Cyclo Convertors (18 hrs)

3.1 Inverter-introduction, working principles, voltage and current driven series and parallel inverters and applications
3.2 Choppers-introduction, types of choppers and their working principles and applications
3.3 Dual converters-introduction, working principles and applications
3.4 Cyclo-converters- introduction, types, working principles and applications

4. Thyristor Control of Electric Drives (15 hrs)

4.1 DC drives control (Basic Concept)
4.2 Half wave drives
4.3 Full wave drives
4.4 Chopper drives
4.5 AC drives control
4.6 Phase control
4.7 Variable frequency a.c. drives
4.8 Constant V/F application
4.9 Voltage controlled inverter drives
4.10 Constant current inverter drives
4.11 Cyclo convertors controlled AC drives
4.12 Slip control AC drives

5 Uninterrupted power supplies (05 hrs)

5.1 UPS online, off line
5.2 Storage devices (batteries)
5.3 SMPS, CVT

LIST OF PRACTICALS

1. To draw V-I characteristics of an SCR
2. To draw V-I characteristics of a TRIAC
3. To draw V-I characteristics of a DIAC
4. To draw uni-junction transistor characteristics

5. Observe the output wave of an UJT relaxation oscillator
6. Observe the wave shape across SCR and load of an illumination control circuit
7. Fan speed regulator using TRIAC Quadriac (fabrication of this circuit)
8. Speed-control of a DC shunt motor or universal motor
9. To observe the output wave shape on CRO of a Single phase half controlled full wave rectifier
10. Single phase controlled rectifier

INSTRUCTIONAL STRATEGY

The teachers may encourage students to perform practical simultaneously for better understanding of the subjects and verification of theoretical concepts. The various components must be shown to the students for identification and also tested. Practical applications of the various circuits and devices should be discussed in the class. The available video films on the subject must be shown to the students.

BOOKS RECOMMENDED

1. Industrial Control Electronics. John Webb, Kevin Greshock, Maxwell, Macmillan International editions.
2. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt. Ltd, New Delhi
3. Power Electronics, Circuits Devices and Applications by Mohammad H. Rashid
4. Power Electronics by PC Sen
5. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
6. Industrial Electronics & Control by SK Bhattacharya & S Chatterji, New Age international Publications(P) Ltd, New Delhi
7. Power Electronics by SK Sahdev, Uneek Publication, Jalandhar
8. Industrial Power Electronics by JC Karhava, King India Publication,
9. Fundamentals of Electrical Drives by Gopal K Dubey, Narosa Publishing House Pvt. Ltd, New Delhi
10. Power Electronics and Controls by Samir K Datta, Prentice Hall of India, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1.	16	25
2.	10	15
3.	18	30
4.	15	20
5.	05	10
Total	**64**	**100**

DIGITAL ELECTRONICS

L	T	P
4	-	2

RATIONALE

This course has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design and microprocessors.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Verify and interpret truth tables for all logic gates.
- Realize all logic functions with NAND and NOR gates
- Design half adder and full adder circuit
- Demonstrate and design 4-bit adder, 2's complement subtractor
- Verify and interpret truth tables for all flip flops.
- Verify and interpret truth tables of multiplexer, de-multiplexer, encoder and decoder ICs
- Design a four bit ring counter and verify its operation
- Design 4-bit SISO, PISO, SIPO, PIPO shift registers

DETAILED CONTENTS

1. Introduction (02 hrs)

   a) Distinction between analog and digital signal.
   b) Applications and advantages of digital signals.

2. Number System (04 hrs)

   a) Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.
   b) Binary addition, subtraction, multiplication and division including binary points. Sign magnitude method of representation, 1’s and 2’s complement method of addition/subtraction, floating point representation

3. Codes and Parity (04 hrs)

a) Concept of code, weighted and non-weighted codes, examples of BCD, excess-3 and Gray code.

b) Concept of parity, single and double parity and error detection and correction (Hamming code)
c) Alpha numeric codes: ASCII, EBCDIC and Unicode.

4. Logic Gates and Families (07 hrs)

a) Concept of negative and positive logic
b) Definition, symbols and truth tables of gates. Construction of NOT, AND and OR gates from NAND and NOR gates (universal gates).
(c) Introduction to TTL and CMOS logic families and their sub classification

5. Logic Simplification (06 hrs)

a) Postulates of Boolean algebra, De Morgan's Theorems. Various identities. Formulation of truth table and Boolean equation for simple problem. Implementation of Boolean (logic) equation with gates

b) Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits

6. Arithmetic circuits (06 hrs)

a) Half adder and Full adder circuit, design and implementation.
b) Half and Full subtracter circuit, design and implementation.
c) 4 bit adder/subtracter.
d) Adder and Subtractor IC (7484)
e) 2-bit comparator

7. Decoders, Multiplexers and De-Multiplexers (06 hrs)

a) Basic functions and block diagram of Encoders and decoders.
b) Basic functions and block diagram of Multiplexers and De-Multiplexers. Different types and ICs.
c) Four bit decoder circuits for 7 segment display and decoder/driver ICs.

8. Latches and flip flops (06 hrs)

a) Concept and types of latch with their working and applications
b) Operation using waveforms and truth tables of RS, T, D, JK and Master/Slave JK flip flops.
c) Difference between a latch and a flip flop
d) Flip flop ICs

9. Shift Register (07 hrs)

Introduction and basic concepts including shift left and shift right.

a) Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
b) Universal shift register
c) Buffer register, Tristate Buffer register
d) IC 7495

10. Counters (08 hrs)

a) Introduction to Asynchronous and Synchronous counters
b) Binary up/down counters (upto MOD-8)
c) Decade counter.
d) Pre settable and programmable counters
e) Ring counter with timing diagram
f) Counter ICs

11. Analog to Digital and Digital to Analog Converters (08 hrs)

a) Working principle of A/D and D/A converters
b) Detail study of :
    - Binary Weighted D/A converter
    - R/2R ladder D/A converter
- Brief idea about different techniques of A/D conversion and study of :
    - Stair step Ramp A/D converter
    - Dual Slope A/D converter
    - Successive Approximation A/D Converter
- Performance characteristics of A/D and D/A converter.
- Applications of A/D and D/A converter.

LIST OF PRACTICALS

1. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR(EXNOR) gates

2. - Realisation of logic functions with the help of NAND or NOR gates
   - Design of a NOR gate latch and verification of its operation

3. - To design a half adder using XOR and NAND gates and verification of its operation
   - Construction of a full adder circuit using XOR and NAND gates and verify its operation

4. To design 4 bit adder, 2's complement subtractor circuit using an 4 bit adder IC and an XOR IC and verify the operation of the circuit.

5. To design a NOR Gate Latch and verification of its operation

6 Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch , D flip-flop, JK flip-flops).

7. Verification of truth table for encoder and decoder ICs, Mux and DeMux

8. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.

9. To design a 4 bit ring counter and verify its operation.

10. Asynchronous Counter ICs

Verification of truth table for any one universal shift register IC

Use of IC 7490 or equivalent TTL (a) divide by 2 (b) divide by 10 Counter

OR

Use of IC 7493 or equivalent TTL (a) divide by 2 (b) divide by 8 (c) divide by 16 counter

Note: Above experiments may preferably be done on Bread Boards.

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. Programming exercises other than the tested in circulation may be given to the students.

RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill Education Pvt Ltd, New Delhi

2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi

3. Digital Circuits and Design by DP Kothari and JS Dhillon, Pearson Publication, New Delhi

4. Digital Electronics by Soumitra Kumar Mandal, Tata McGraw Hill Education Pvt Ltd.

5. Digital Electronics by Tokheim, Tata McGraw Hill Education Pvt Ltd.
6. Digital Fundamentals by Thomas Floyds, Universal Book Stall
7. Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi
8. Digital Electronics by KS Jamwal, Dhanpat Rai and Co., New Delhi
9. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
10. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
11. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Hrs)**	**Marks Allocation (%)**
1.	2	5
2.	4	5
3.	4	5
4.	7	15
5.	6	10
6.	6	10
7.	6	10
8.	6	10
9	7	10
10.	8	10
11.	8	10
Total	**64**	**100**

4.5 COMPUTER APPLICATIONS IN ELECTRICAL INSTALLATIONS

L	T	P
-	-	4

RATIONALE

Computer plays a very vital role in present day life, more so, in the professional life of Diploma engineers. In order to enable the students use the computers effectively, this course offers exposure to various engineering applications of computers in electrical engineering. The practical exercises and demonstration of application software in the field of electrical engineering during the course of study will help the students in getting the employment.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Use MATLAB and SCILAB for solving problems and designing electrical systems
- Explain the utility of software – LABVIEW, PROTEUS AND MULTISIM software along with electrical CAD

DETAILED CONTENTS

PRACTICAL EXERCISES:

1. MATLAB and SCILAB

   - Introduction to MATLAB, MATLAB Programming – input/output, types of graphs, functions, loops, structures, Control System tool box, SIMULINK programmimg, Hardware Interfacing using Arduino and MATLAB

   - Programming concepts of SCILAB- Matrices, Polynomials, Plots, XCOS

2. LABVIEW

   Graphical Programming using LabVIEW including creation of VIs, subVIs, structures, arrays, clusters, charts and graphs, strings, File I/Os.Data Acquisition by building DAQVIs and using hardware, Practice on NI ELVIS and other DAQ hardware

3. PROTEUS & MULTISIM SOFTWARE

- Circuit simulation using Proteus software, Designing circuit in Multisim
- Exporting design in Multisim to LabVIEW
- Electrical CAD or any other equivalent open source software for Electrical System Design

RECOMMENDED BOOKS

1. MATLAB and SIMULINK for Engineers, Agam Kumar Tyagi, Oxford, 2011.
2. MATLAB 7 by RudraPratap, Oxford University Press.
3. MATLAB Programming for Engineers by Stephen J. Chapman
4. MATLAB and Its Applications In Engineering by R.K. Bansal, A.K. Goel
5. Virtual Instrumentation Using LabVIEWKindle Edition by Jovitha Jerome, PHI, 2010
6. Introduction to Multisim for Electric Circuits, James W. Nilsson and Susan Riedel, 2014.

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 OUTCOME

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) and choke

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.

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics by experts. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business