DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

III YEAR

**M SCHEME**

V SEMESTER

2015 – 2016 onwards

# ELECTRICAL ESTIMATION AND ENERGY AUDITING

CURRICULUM DEVELOPMENT CENTRE

**DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING**

**M - SCHEME**

Course Name : Diploma in Electrical and Electronics Engineering

Subject Code : 33053

Semester : V Semester

Subject Title : **ELECTRICAL ESTIMATION AND ENERGY AUDITING**

**TEACHING AND SCHEME OF EXAMINATION:**

No. of weeks per Semester: 15 Weeks

| Subject | Instruction | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| **ELECTRICAL ESTIMATION AND ENERGY AUDITING** | 5 | 75 | 25 | 75 | 100 | 3 hrs |

**TOPICS AND ALLOCATION OF HOURS:**

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | Systems Of Internal Wiring And Earthing | 14 |
| II | Domestic and Industrial Estimate | 12 |
| III | Energy Management & Audit | 13 |
| IV | Electric Motors & Lighting System | 12 |
| V | Diesel Generating System & Energy Efficient Technologies In Electrical Systems | 12 |
| | Revision And Tests | 12 |
| | **TOTAL** | **75** |

**RATIONALE:**

Energy Audit is the key to a systematic approach for decision-making in the area of energy management. The effective use of energy to maximize profits (minimize costs) and enhance competitive positions, it is necessary to conserve energy. Hence it is necessary to study energy auditing methods and energy saving opportunities in electrical system.

**OBJECTIVES:**

On completion of the following units of syllabus contents, the students must be able to

- Draw conventional symbols for various electrical installations.
- To quote the relevant IE rules for a given electrical installation, earthing and clearance of service lines.
- Familiarize the types of wiring.
- List the points to be considered for selection wiring.
- Determine the size of wire for internal wiring.
- Explain the necessity and types of earthing.
- Estimate the quantity of materials required for earthing.
- Differentiate between neutral and earth wire.
- Estimate the quantity of materials required for domestic and industrial wiring.
- Explain the concept and types of Energy of energy audit.
- Explain the energy saving opportunities in Transformer, Induction motor, lighting and DG system.
- Explain the roll of power factor controller in energy saving system.
- Explain the roll of sensors in energy saving system.
- Explain the energy efficient technologies in electrical system.

## DETAILED SYLLABUS

### CONTENTS

| UNIT | NAME OF THE TOPICS | HOURS |
|---|---|---|
| I | **SYSTEMS OF INTERNAL WIRING AND EARTHING**<br>Need of electrical symbols – List of symbols – Brief study of important Indian Electricity Rules 1956 - Methods of representation for wiring diagrams – Looping back system and Joint box system and tree system of wiring - Types of internal wiring – Service connection ( Overhead and Underground) - Protection of electrical installation against overload, short circuit and earth fault – protection against electric shock – Effects of electric shock – Recommended first aid for electric shock - Treatment for electric shock - Construction and working of ELCB – Overview of Busbar Trunking and Cable tray.<br>Necessity – General requirements of Earthing – Earthing and Soil Resistivity – Earth electrodes – Methods of earthing - Plate earthing - Pipe earthing - Rod earthing – Soil Resistivity – Methods of improving earth resistance - Size of earth continuity conductor - Difference between Neutral and Earth Wires.<br>Safety signs showing type of PPE to be worn, Prohibition Signs, Warning Signs, Mandatory Signs, Advisory or Safe Condition Signs. | 14 |
| II | **DOMESTIC AND INDUSTRIAL ESTIMATE**<br>General requirements of electrical installations for Residential, Commercial and Industrial – Lighting and power sub-circuits – Diversity factor for sub circuits - Location of outlets, control switches, main board and distribution boards – Permissible voltage drops and size of wires - Steps to be followed in preparing electrical estimate.<br>Estimate the quantity of material required in Electrical Installation for<br>1. Small residential building/Flat<br>2. Factory Lighting scheme<br>3. Computer centre having 10 computers, a/c unit, UPS, light and fan.<br>4. Street Light service having 12 lamp light fitting<br>5. Workshop with one number of 3Φ, 15hp induction motor.<br>6. Small Workshop with 3 or 4 Machines. | 12 |

| | | |
|---|---|---|
| III | **ENERGY MANAGEMENT & AUDIT AND ELECTRICAL SYSTEM:**<br>**Energy Management & Audit**<br>Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach- Understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit Instruments.<br>**Electrical system:**<br>Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses. | 13 |
| IV | **ELECTRIC MOTORS & LIGHTING SYSTEM**<br>**Electric motors**<br>Types, Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, Energy saving opportunities with energy efficient motors.<br>**Lighting System**<br>Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues. | 12 |
| V | **DIESEL GENERATING SYSTEM & ENERGY EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS**<br>**Diesel Generating system**<br>Factors affecting selection, Energy performance assessment of diesel conservation avenues.<br>**Energy Efficient Technologies in Electrical Systems:**<br>Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology. | 12 |

**TEXT BOOK**

| S.No | TITLE | AUTHOR(S) | PUBLISHERS | EDITION |
|---|---|---|---|---|
| 1 | Electrical Design Estimating And Costing | K.B.Raina& S.K.Battacharya | New age International Ltd | Reprint - 2011 |
| 2 | Book 1 - General Aspect Of Energy Management And Energy Audit | - | Bureau of energy efficiency, new Delhi | Second-2005 |
| 3 | Book 3 - Energy Efficiency In Electrical Utilities | - | Bureau of energy efficiency, new Delhi | Second-2005 |

**REFERENCE BOOK**

| S.No | TITLE | AUTHOR(S) | PUBLISHERS | EDITION |
|---|---|---|---|---|
| 1 | Electrical Wiring, Estimating and Costing | Dr.S.L.Uppal G.C. Garg | Khanna publishers. | Sixth-2011 |
| 2 | Electrical Estimation and Costing | Surjit Singh | Khanna publishers. | |
| 3 | Energy Auditing in Electrical Utilities | Rajiv Shankar | Viva Books - 2010 | |
| 4 | Energy engineering and Management | Amlan Chakrabarti | PHI Learning Pvt Ltd - 2011 | |