

**Course Title: Industrial Electrification and Control**

**Course Code: EPEG 427**

**Credit Hours: 3**

**Course Description:**

The course addresses the aspects of electric power distribution systems for commercial and industrial complexes with emphasis to lighting, motor control and modern automation control systems

**Course Contents:**

**Unit 1: System components for Industrial electrification**

Supply system for residential, commercial and industrial complex, industrial complex, service mains, Distribution board system, types of wires and cables, insulating materials, wiring conduits and wiring ducts, cable termination, bus-ways and types, wire/cable voltage and current rating, allowable voltage drop in cables, wire cable sizing, fuse and types, miniature circuit breakers, moulded case circuit breaker, switches, fixtures, outlets, panel boards and sizing, Earthing and earthing conductors, electrical safety, earth leakage circuit breaker, lightning protection, energy meter

**Unit 2: Design of Lighting System**

Terms used in illumination, Laws of illumination, Types of artificial light sources: incandescent lamps, arc lamps, discharge lamps, sodium vapor lamps, mercury vapor lamps, neon lamps, fluorescent lamps, LED lamps; Stroboscopic effect, polar curves, Space height ratio, coefficient of utilization, maintenance factor, spacing of lights, Different types of light arrangements, selection of luminaires, Evaluation of light requirements for specific tasks, Calculation of illumination, internal and external lighting requirements, factory lighting, security lighting, Street lighting, Flood lighting

**Unit 3: Electrical layout drawing and estimate**

Types of load in buildings and industries, general rules for wiring, requirements and types of wiring, Schematic diagram, wiring diagram, single line diagram, Nepal standards for electrical wiring and layout, Electrical layout drawing for buildings and commercial complexes: light circuit, power circuit and communication circuits, choice of supply, Estimation of electrical layout for buildings, load factor, demand factor, diversity factor, Load center and wiring sizing calculation for an industrial complex, economics of power factor improvement

**Unit 4: Electrical Requirements for Moving and Heating Systems**

Energy and power requirements for: Lifts, elevator, walk-ways, conveyor belts; alternative drive systems: AC, DC, controlled rectifiers, matching of electric drives to meet torque/speed requirements of loads; Electric heating and methods, building design consideration for electric heating, Heating, Ventilation and Air Conditioning (HVAC)

**Unit 5: Industrial Motor control**

Motor control circuits – contactor control circuit components, Use of contactor, relays, over current protection, timer, Wiring and control diagram for direct on line starting of three phase

induction motor, motor fed from two supply, reversing, remote control operation, Sequence operation of motors with interlocking, Manual start delta starter for 3 phase induction motor, two speed control, Automatic star-delta starter for a three phase induction motor, Application of motors for particular services, variable frequency drive control

#### **Unit 6: Programmable Logic Controller for Industrial Control**

Application of Programmable Logic Controller (PLC) for industrial control, Wiring of PLC for industrial control, supervisory control and data acquisition (SCADA) and Energy Management System (EMS) for Industry, Case studies of industrial process control

#### **Unit 7: Backup Electrical Supplies for Industrial Plants**

Photovoltaic systems, Diesel generator, Battery, uninterruptable supplies, sizing of backup systems for commercial and industrial requirements, hybrid backup systems

#### **Unit 8: Electrical Energy Conservation and Audit**

Electrical Energy Conservation approaches in residential, commercial and industrial complexes, Energy Audit and its benefits, methodology for preliminary energy audit and detailed energy audit, Energy Audit Report, Rules and regulations for energy audit

#### **References:**

1. K.B. Raina and S.K. Bhattacharya, *Electrical Design Estimating and Costing*, New Age International (P) Limited
2. V.K. Jain, and A. Bajaj, *A text book of Design of Electrical Installations*, Laxmi Publications.
3. R.K.Rajput, *Utilisation of Electrical Power*, Laxmi Publications
4. E.A. Parr, *Programmable Controllers*, Newnes

#### **Evaluation:**

In-Semester Evaluation: 50%

End-Semester Evaluation: 50%