**19EE31E3-INDUSTRIAL ELECTRICAL SYSTEMS**

**(EEE)**

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Electric power systems | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn: | |
| 1. About electrical system components. 2. The different types of residential and commercial wiring systems. 3. The concepts of refrigeration, air conditioning and heating of buildings. 4. About the industrial loads, SLD cable and switchgear selection, KVAR calculations, types of compensation, PCC and MCC panels. 5. The DG, UPS systems, elevators, battery banks, sizing and selection. 6. The basics of PLC, control system design – SCADA system for distribution automation of industrial electrical systems. | |
| **Course Outcomes:** | After completing the course the student will be able to: | |
| **CO1** | Explain the electrical wiring system components and single line diagram |
| **CO2** | Understand the electrical wiring systems for residential and commercial consumers, sizing of wire and protection devices |
| **CO3** | Analyze the concepts of refrigeration, air conditioning and heating of buildings |
| **CO4** | Enumerate various components of industrial electrical systems |
| **CO5** | Design and select the proper size of various electrical system components |
| **CO6** | Demonstrate the role in automation and PLC based control system design |
| **Course Content:**  **Course Content:** | **UNIT-I**  **Electrical system components:** LT system wiring components, selection of cables- wires- switches- distribution box- metering system- tariff structure- protection components-fuse-MCB- MCCB- ELCB-inverse current characteristics- symbols- single line diagram of a wiring system- contactor- isolator- relays- MPCB- electrical shock  and electrical safety practices.  **UNIT-II**  **Residential and commercial electrical systems:** Types of residential and commercial wiring systems- general rules and guidelines for installation- load calculation and sizing of wire- rating of main switch- distribution board and protection devices- earthing system calculations- requirements of commercial installation-deciding lighting scheme and number of lamps-earthing of commercial installation- selection and sizing of components.  **UNIT-III**  **Refrigeration**: Refrigeration cycle- different refrigeration systems- domestic refrigerator & different types of water coolers- control of temperature- protection of motors- simple heat load and motor calculations.  **Air-conditioning**: Function of complete air conditioning system- types of air conditioning system- types of compressor motor- cool storage - estimation of tonnage capacity and motor power.  **Heating of buildings**: Types of heating equipment used for space heating, calculation of rating of electrical equipment.  **UNIT- IV**  **Industrial electrical systems I:**HT connection- industrial substation- transformer selection- industrial loads- motors- starting of motors-SLD- cable and switchgear selection- lightning protection-, earthing design- power factor correction- kVAR calculations- type of compensation- Introduction to PCC- MCC panels- specifications of LT breakers- MCB and other LT panel components.  **UNIT-V**  **Industrial electrical systems II:**DG systems- UPS systems- electrical systems for the elevators- battery banks- sizing the DG- UPS and battery banks- selection of UPS and battery banks.  **UNIT-VI**  **Industrial electrical system automation:** Study of basic PLC- role in automation- advantages of process automation- PLC based control system design- panel metering and introduction to SCADA system for distribution automation. | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1. “Electrical wiring, estimating &costing”, by S. L. Uppal and G.C. Grag, Khanna publishers, 2008.  2. “Electrical design, estimating &costing”, by K.B. Raina, New Age  International, 2007.  3. “Electrical estimating and costing”, by S. Singh and R. D. Singh, DhanpatRai and Co., 1997.  **Reference books:**  1. “Residential commercial and industrial systems”, by H. Joshi, McGraw Hill Education, 2008.  2.“Course in electric power”, by M.L.Soni, P.V. Gupta, U.S.Bhatnagar, DhanapatRai& sons publication. | |
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