Utilization of Electrical Energy

**Course Objectives:**  
To present the basic concepts on utilization of electrical energy on various applications

1. **Introduction  [4 hours]**
   1. Common uses of electrical energy: Domestic, commercial, industrial
   2. Classification of electrical consumers and their demand
   3. Roles and advantages of electrical energy over other forms of energy on different applications

1. **Electric Drive System  [8 hours]**
   1. Advantages of electric drive
   2. Types of electric drives- Individual, group and multi-motor and comparison among them
   3. Methods of power transfer- Direct coupling/using belt drive, gears, pulleys
   4. Selection of motors- Factors to be considered, electrical and mechanical characteristics matching.
   5. Service Type (Continuous, Intermittent), Rating and Sizing of motor
   6. Motors and their characteristics for particular service- domestic, industrial and commercial

1. **Control of Electric Drive  [12 hours]**
   1. DC Drive Control
      1. Background of AC Drive System
      2. Ward Leonard type variable speed drives
      3. Static Variable DC voltage drives using diodes and/or controlled rectifier
      4. 4-quadrant reversible voltage and power flow drive
      5. PID speed and torque controlled drives
   2. AC Drive Control
      1. Background of AC Drive System
      2. Soft start variable ac voltage starter
      3. Variable frequency supplies for ac drive
      4. Slip power recovery system for slip ring induction motor

1. **Electric Traction [8 hours]**
   1. Types of electric traction- self contained unit system, traction system fed from a separate distribution line, DC and AC supply system
   2. Advantages of electric traction system
   3. Tramways, trolley, and electric train: description and comparison
   4. Types of motors used for electric traction
   5. Starting, Braking and Speed control of traction motors
   6. Speed-time curve for a traction system: Scheduled and Average speed and factors affecting these speeds

1. **Electric Heating [6 hours]**
   1. Introduction of Electrical Heating
   2. Advantages of electric heating
   3. Building design consideration for electric heating
   4. Methods of electric heating: Resistance heating, Induction heating, Electric arc heating, Dielectric heating, Infrared heating, and Micro-wave heating

1. **Demand Side Management  [8 hours]**
   1. Introduction and advantages of Demand Side Management
   2. Consumer Classification and their demand characteristics
   3. Effective Demand Side Management techniques
   4. Causes and disadvantages of Low Power Factor and different techniques to improve Power Factor
   5. Types of tariff: Simple tariff, Flat-rate tariff, Block-rate tariff, Two part tariff, Maximum demand tariff
   6. Tariff System in Nepal

**Laboratory:**

1. Speed Control of DC shunt motor by controlled rectifier
2. Speed Control of Induction motor by rotor rheostat method
3. Speed Control of Induction motor by frequency control method
4. Study of PWM controller for an ac machine

**Reference:**

1. A course in Utilization of Electrical Energy, *G. Garg*
2. A course in Electrical Drives, *S. K. Pillai*
3. Utilization of electrical energy, *Taylor*

**Evaluation scheme:**  
The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Hours** | **Marks Distribution\*** |
| 1. | 4 | 8 |
| 2. | 8 | 16 |
| 3. | 12 | 16 |
| 4. | 8 | 16 |
| 5. | 6 | 8 |
| 6. | 8 | 16 |
| **Total** | **46** | **80** |

**\*Note: There may be minor deviation in marks distribution.**