Transmission and Distribution System Design

**Course Objectives:**  
To address general matters of electrical power and energy demand load characteristics, technical requirements and economic principles related to design of transmission lines and distribution systems.

1. **Introduction[4 hours]**
   1. Advantages of grid systems
   2. Transmission line design & planning
   3. Technical and economic comparison of ac and dc transmission
   4. Physical structures of transmission lines: ampacities, towers, sire choices, insulation and protection against lightning, shielding, grounding, sagging and clearances
   5. Right-of-way and other design and construction problems, terrain and weather implications
   6. Transmission system design for Nepal

1. **Transmission voltage level and number of circuit selection[4 hours]**
   1. Effect of voltage level in power and energy loss, conductor and insulator economy
   2. Technical aspects of alternating current overhead lines: power and VAR transmission capability as functions of line length, line impedance and voltage level,
   3. choice of voltage level  for transmission for single and multiple circuit

1. **Overhead line insulator design[8 hours]**
   1. Factors affecting insulator design
   2. Air clearance computations, shield wires and tower grounding
   3. Overhead line insulator material, types of overhead line insulators
   4. Advantages of string insulators, string efficiency, string insulator configurations
   5. Selection of overhead line insulators considering continuous operating voltage and over voltages

1. **Conductor & support  selections[10 hours]**
   1. Electrical, mechanical and economical requirements
   2. Conductor material and preliminary size selection
   3. Meeting electrical requirements; voltage regulation, efficiency, corona etc.
   4. conductor choices, wire types and size, bundled conductors
   5. economical size determination
   6. Route selection for transmission lines
   7. Surveying requirements for transmission line design and construction
   8. mechanical aspects; tensioning and sagging, stringing chart, supports at unequal level
   9. tower design: span selection, ground clearance, moments acting on tower and tower strength computation

1. **Electric power Distribution[4 hours]**
   1. Underground and overhead lines systems
   2. Radial and networked systems.
   3. Distribution equipment: overhead lines, single phase and there phase cables, distribution transformers, switcher
   4. Voltage levels, regulation, compensation
   5. Urban and rural distribution system
   6. Right-of-way, effects of terrain and weather and other construction problems
   7. Distribution practices in rural and urban Nepal

1. **Electrical loads Characteristics  & Load forecast[7 hours]**
   1. Characterization of loads: domestic, commercial, industrial
   2. Time dependence of electrical loads: load duration curves, load factor, daily variation, seasonal and annual variation, long and short term prediction of load, effects of conservation, effects of rates, diversity, load uncertainty
   3. Characteristics of electric loads in Nepal
   4. Load forecasting techniques, small area load forecast

1. **Distribution system design[5 hours]**
   1. Load center selection
   2. Selection of distribution transformer locations, their sizes and primary voltage level
   3. selection of distribution line layout, distribution transformers, overhead lines and/or cables protection
   4. evaluation of capital and operation costs

**Practical:**  
**A .   Design of an overhead transmission line(25 hour)**

1. Evaluation Of Electrical Requirements
2. Choice Of Ac Or Dc, Voltage Level, Conductors, Insulators
3. Route Selection Form Maps
4. Civil And Mechanical Engineering Aspects: Right-Of-Way, Tower Design, Tensioning, Sagging, Construction Aspects
5. Electrical performance: regulation, stability compensation, protecton

**B.    Design of a distribution system(15 hour)**

1. Evaluation Of Loads: Growth, Geographical Distribution
2. Selection Of Distribution Line Layout, Distribution Transformers, Overhead Lines And/Or Cables Protection
3. Evaluation Of Capital And Operation Costs

**References:**

1. Elgerd, "Electric Energy Systems Theory," McGrow Hill
2. Stevnsion, "Elements of Power System Analysis," McGrow Hill
3. Deshpande, "Elements of Electrical Power system Design," Pitman and Sons
4. Marsh, Economics of Electric Utility Power Generation," Clarendon Press

**Evaluation Scheme:**

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| --- | --- | --- |
| **Chapter** | **Hours** | **Marks Distributions\*** |
| 1 | 4 | 8 |
| 2 | 4 | 8 |
| 3 | 8 | 16 |
| 4 | 10 | 16 |
| 5 | 4 | 8 |
| 6 | 7 | 16 |
| 7 | 5 | 8 |

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