Power Plant Equipment

**Course Objective:**  
To present information on the equipment used in power generating plant including electrical as well as mechanical

**Part – A (Electrical)**

1. **Hydro Power Plant (6 hours)**
   1. Energy Conversion from hydraulic to electrical terminologies
   2. Steady State operation of  hydro power plant
   3. Water hammer and surge tank in hydro power plant
   4. Control of water delivery to turbine
   5. Transient in turbine –generator system
   6. Pump storage plant
   7. Generator for hydro power plants

1. **Power/frequency control in hydro generator system (10 hours)**
   1. f and Q-V control loop of hydro generating system
   2. Modeling of turbine
   3. Special characteristics of hydraulic turbine
   4. Modeling of governor
      1. Fundamentals of speed governing
      2. Generator response to load change
      3. Isochronous Governor
      4. Governor with droop characteristics
      5. Load sharing by parallel unit
      6. Requirement of transient droop

1. **Var/Voltage control in hydrogenerating systems (6 hours)**
   1. Types of excitation systems-
      1. DC excitation system
      2. AC excitation system
      3. Static excitation system
   2. Modeling of excitation systems

1. **Substation equipments (8 hours)**
   1. Power transformer and its various components
   2. Concept of unit transformer
   3. Potential transformer and current transformer used in substation
   4. Reactor used in generating station and substation
   5. Fire fighting system in power station
   6. Power Line Carrier Communication (PLCC)
   7. PLC Application
   8. Supervisory Control and Data Acquisition (SCADA) System and communication with load dispatch center

**Part – B (Mechanical)**

1. **Diesel Power Plant (10 hours)**
   1. Diesel Cycle
   2. Diesel Engine Operation, Starting, Fuel Storage and Supply System, Cooling System, Noise Abatement and Governing
   3. Performance of Diesel Power Plant
   4. Applications of Diesel Power Plant
   5. Advantages and Disadvantages of Diesel Power Plant

1. **Gas Turbine Power Plant (7 hours)**
   1. Gas Turbine Cycle; Open and Closed Cycles
   2. Performance Improvement of Gas Turbine Power Plants; Intercooling, Regeneration and Reheating
   3. Starting, Fuel Storage and Supply System, Cooling System, Noise Abatement and Governing
   4. Advantages and Disadvantages of Gas Turbine Power Plant

1. **Thermal (Steam) Power Plant (7 hours)**
   1. Rankine cycle
   2. Performance Analysis, superheating reheating and regeneration
   3. Steam Turbine: Classifications, Compounding, Governing and Lubrication systems for Steam Turbines
   4. Advantages and Disadvantages Thermal Power Plants

1. **Combined Power Plant (6 hours)**
   1. Gas and Steam Turbine Combined Cycle
   2. Advantages of Combined Cycle
   3. Performance and Economics of Combined Cycle

**Practical:**

1. Mini hydro Unit Control (Isolated Load)
2. Study the start –up and control of speed and generated voltage on the mini hydro unit, operating the generator on isolated load (not synchronized to the lab bus)
3. Mini hydro Unit Control (Synchronized)
4. Start up and synchronized to system bus
5. Study power and var control of the unit while synchronized and delivering energy to the system
6. Diesel Unit Control (Isolated Load)
7. As per lab #1
8. Diesel Unit Control (Synchronized)
9. As per lab #2
10. Load sharing between parallel units
11. Operate mini hydro and diesel generating units in parallel to supply a common load.
12. Examine control problems associated with load and var sharing
13. Field trip to generating plant ( 3 days trip)visit a full size operating generating plant
14. study the specific component and its operating mechanism of the visited power plant
15. Prepare a formal report on power plant installation describing specific major component

**Reference:**

1. P.Kundur “Power System Stability and Control”  Mc Graw Hill Inc
2. D.P. Kothari “Power System Engineering”
3. Hadi Sadat “Power System ”
4. S.C. Arora, S. Domkundwar “ A course in power plant Engineering”
5. P.C. Sharma “Power Plant Engineering”

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

|  |  |  |
| --- | --- | --- |
| **Chapters** | **Hours** | **Marks Distribution\*** |
| 1 | 6 | 8 |
| 2 | 10 | 16 |
| 3 | 6 | 8 |
| 4 | 8 | 8 |
| 5 | 10 | 16 |
| 6 | 7 | 8 |
| 7 | 7 | 8 |
| 8 | 6 | 8 |
| **Total** | **60** | **80** |

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