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| <b>GOVT POLYTECHNIC BOLANGIR</b>   |
| <b>Department of Mechanical Engineering</b>                                      |
| <b>LESSON PLAN: 2025-26</b>  |
| <b>Name of the Faculty: Rasmi Ranjan Jena (Lecturer Stage-I)</b>                 |
| <b>Subject: Power Station Engineering-TH3</b>                                    |
| Program: Diploma in Mechanical Engineering Semester: 6th Total Contact Hours: 60 |
| Total Marks: 100 Assessment: Progressive –20, End Term – 80                      |
| Credits: 4   |

#### **COURSE OBJECTIVES:**

After completion of the course, the students will be able to

- 1.Understand the generation of power by utilizing various energy sources.
- 2.Understand the use of steam, its operation in thermal power stations.
3. Understand the nuclear energy sources and power developed in nuclear power station.
4. Understand the basics of diesel electric power station and hydroelectric power station.
- 5.Understand the basics of gas turbine power station.

| <b>UNIT-I:Introduction to Power Generation (5 Classes)</b> |   |  |                                   |            |
|--|---|--|-----------------------------------|------------|
| <b>Class No.</b>   | <b>Topic</b>                            | <b>Sub topics to be Covered</b>  | <b>Teaching Aids / Activities</b> | <b>COs</b> |
| 1  | Sources of Energy                       | Definition of energy,Conventional energy sources,Non-conventional energy sources,Renewable vs non-renewable      | Chalk & board                     | CO1        |
| 2  | Power Stations – Basic Concepts         | Definition of power station,Central power station,Captive power station,Advantages and examples                  | PPT, Chalk & board                | CO1        |
| 3  | Classification of Power Plants          | Thermal power plant,Hydroelectric power plant,Nuclear power plant,Diesel & gas turbine power plants              | PPT, Chalk & board                | CO1        |
| 4  | Importance of Electrical Power          | Role of electricity in domestic life,Industrial applications,Transportation & communication,National development | PPT, Chalk & board                | CO1        |
| 5  | Overview of Electrical Power Generation | Basic principle of power generation,Energy conversion stages,Block diagram of power generation system            | PPT, Chalk & board                | CO1 & CO4  |

## UNIT-II:Thermal Power Stations (20 Classes)

|           |  |  |                    |          |
|-----------|--|--|--------------------|----------|
| <b>6</b>  | Introduction to Thermal Power Stations | Definition of thermal power station,Importance,Capacity range & applications | PPT, Chalk & board | CO2      |
| <b>7</b>  | Layout of Steam Power Station          | Main components,Block diagram,Energy conversion stages                       | PPT, Chalk & board | CO2      |
| <b>8</b>  | Steam Power Cycles – Overview          | Need of power cycles,Vapour power cycle concept                              | Chalk & board      | CO2      |
| <b>9</b>  | Carnot Vapour Power Cycle              | Carnot cycle processes,P-V diagram,T-S diagram                               | Chalk & board      | CO2      |
| <b>10</b> | Carnot Cycle – Performance             | Thermal efficiency derivation,Limitations of Carnot cycle                    | Chalk & board      | CO4      |
| <b>11</b> | Rankine Cycle – Introduction           | Rankine cycle processes,Comparison with Carnot cycle                         | Chalk & board      | CO1      |
| <b>12</b> | Rankine Cycle Diagrams                 | P-V diagram,T-S diagram,H-S diagram  | PPT, Chalk & board | CO2 &CO3 |
| <b>13</b> | Rankine Cycle – Performance            | Thermal efficiency,Work done,Work ratio                                      | PPT, Chalk & board | CO2      |
| <b>14</b> | Rankine Cycle – SSC & Problems         | Specific steam consumption,Simple numerical problems                         | PPT, Chalk & board | CO2      |
| <b>15</b> | Thermal Power Stations in the State    | List of thermal power stations,Installed capacities                          | PPT, Chalk & board | CO2 &CO3 |
| <b>16</b> | Boiler Accessories – I                 | Air preheater – operation,Economiser – operation                             | PPT, Chalk & board | CO2      |
| <b>17</b> | Boiler Accessories – II                | Super heater – operation,Electrostatic precipitator – operation              | PPT, Chalk & board | CO2      |
| <b>18</b> | Boiler Mountings                       | Need of boiler mountings,Safety & control aspects                            | PPT, Chalk & board | CO2      |
| <b>19</b> | Draught Systems – I                    | Natural draught,Forced draught   | PPT, Chalk & board | CO2      |
| <b>20</b> | Draught Systems – II                   | Balanced draught,Advantages & disadvantages                                  | PPT, Chalk & board | CO2      |
| <b>21</b> | Steam Prime Movers                     | Steam turbine – advantages & disadvantages,Elements of steam turbine         | PPT, Chalk & board | CO2      |
| <b>22</b> | Governing of Steam Turbines            | Need of governing,Methods of governing                                       | PPT, Chalk & board | CO2      |

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| 23 | Performance of Steam Turbine            | Thermal efficiency, Stage efficiency, Gross efficiency                                      | PPT, Chalk & board | CO2 |
| 24 | Steam Condenser & Cooling System        | Function & classification of condenser, Condenser auxiliaries, Cooling towers & spray ponds | PPT, Chalk & board | CO2 |
| 25 | Site Selection of Thermal Power Station | Factors affecting site selection, Revision & recap  | PPT, Chalk & board | CO2 |

### UNIT-III:Nuclear Power Stations (10 Classes)

|    |  |   |                            |     |
|----|--|---|----------------------------|-----|
| 26 | Introduction to Nuclear Energy           | Need of nuclear power, Basic concept of nuclear energy, Advantages & limitations  | PPT, cut-section images    | CO3 |
| 27 | Classification of Nuclear Fuels          | Fissile materials, Fertile materials, Examples of nuclear fuels                   | PPT, Chalk & board         | CO3 |
| 28 | Nuclear Reactions                        | Nuclear fission reaction, Nuclear fusion reaction, Comparison of fission & fusion | PPT, Chalk & board         | CO3 |
| 29 | Nuclear Power Plant – Overview           | Layout of nuclear power plant, Block diagram, v                                   | PPT, discussion            | CO3 |
| 30 | Nuclear Reactor – Introduction           | Function of nuclear reactor, Main parts of reactor                                | PPT, Chalk & board, Models | CO2 |
| 31 | Nuclear Reactor – Working                | Working principle, Moderator, control rods, coolant, shielding                    | Real component / PPT       | CO3 |
| 32 | Nuclear vs Thermal Power Plant           | Comparison based on fuel, efficiency, cost, safety & pollution                    | PPT, Chalk & board         | CO3 |
| 33 | Nuclear Waste Disposal                   | Types of nuclear waste, Disposal methods, Safety measures                         | PPT, Chalk & board         | CO3 |
| 34 | Site Selection for Nuclear Power Station | Factors affecting site selection, Safety & environmental considerations           | PPT, Chalk & board         | CO3 |
| 35 | Nuclear Power Stations                   | List of nuclear power stations, Installed capacities, Revision                    | PPT, Chalk & board         | CO3 |

### UNIT-IV:Diesel Electric Power Stations (10 Classes)

|    |  |   |                    |     |
|----|--|---|--------------------|-----|
| 36 | Introduction to Diesel Electric Power Stations | Definition of diesel electric power station, Applications, Capacity range                                     | PPT, Chalk & board | CO4 |
| 37 | Advantages & Disadvantages                     | Advantages of diesel power stations, Disadvantages of diesel power stations, Comparison with thermal stations | PPT, Chalk & board | CO4 |

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|----|-----------------------------------|--|--------------------|-----|
| 38 | Fuel Storage & Fuel Supply System | Fuel storage system,Fuel transfer and filtration,Fuel supply system          | PPT, Chalk & board | CO4 |
| 39 | Fuel Injection System             | Fuel injection pump,Injectors,Function and importance                        | Chalk & board      | CO4 |
| 40 | Air Supply & Exhaust System       | Air intake system,Supercharging (brief),Exhaust system                       | Chalk & board      | CO4 |
| 41 | Cooling System                    | Need for cooling,Types of cooling systems,Components                         | Chalk & board      | CO4 |
| 42 | Lubrication & Starting System     | Lubrication system,Types of starting systems,Importance                      | PPT, Chalk & board | CO4 |
| 43 | Governing System                  | Need of governing,Types of governing systems,Speed control                   | PPT, discussion    | CO4 |
| 44 | Site Selection                    | Factors affecting site selection,Practical considerations                    | PPT, Chalk & board | CO4 |
| 45 | Performance & Thermal Efficiency  | Performance parameters,Thermal efficiency,Simple numerical problems,Revision | PPT, Chalk & board | CO4 |

#### UNIT-V:Hydel Power Stations (10 Classes)

|    |   |   |                    |     |
|----|---|---|--------------------|-----|
| 46 | Introduction to Hydel Power Stations      | Definition and importance,Advantages and disadvantages                              | PPT, Chalk & board | CO4 |
| 47 | Classification of Hydel Projects          | Storage type,Run-of-the-river type,Pumped storage type                              | PPT, Chalk & board | CO4 |
| 48 | General Arrangement of Storage Type Plant | Components: Dam, reservoir, penstock, powerhouse,Flow of waterOperation of plant    | PPT, Chalk & board | CO4 |
| 49 | Site Selection                            | Factors affecting site selection,Practical considerations                           | PPT, Chalk & board | CO4 |
| 50 | List of Hydel Power Stations              | Hydel power stations in the state,Installed capacities                              | PPT, Chalk & board | CO4 |
| 51 | Turbines Used                             | Types of turbines: Pelton, Francis, Kaplan,Applications based on head and discharge | Chalk & board      | CO4 |
| 52 | Generators                                | Type of electrical generators used,Coupling with turbine                            | PPT, Chalk & board | CO4 |
| 53 | Operation of Hydel Plant                  | Flow control,Load handling,Start-up and shutdown procedure                          | PPT, Chalk & board | CO4 |

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| 54   | Simple Numerical Problems                 | Calculation of power developed, Efficiency, Discharge & head                             | Chalk & board      | CO4 |
| 55   | Revision & Summary                        | Recap all topics, Q&A session, Short test  | PPT, Chalk & board | CO4 |
| <b>UNIT-VI: Gas Turbine Power Stations (5 Classes)</b> |   |  |                    |     |
| 56   | Introduction to Gas Turbine Power Station | Definition and importance, Comparison with other power plants                            | PPT, Chalk & board | CO5 |
| 57   | Site Selection                            | Factors affecting site selection, Practical considerations                               | PPT, Chalk & board | CO5 |
| 58   | Fuels for Gas Turbine                     | Types of fuels: natural gas, diesel, kerosene, LPG, Fuel properties & selection criteria | PPT, Chalk & board | CO5 |
| 59   | Elements of Gas Turbine Power Plant       | Compressor, Combustion chamber, Turbine, Generator, Layout of plant                      | PPT, Chalk & board | CO5 |
| 60   | Merits, Demerits & Applications           | Advantages & disadvantages, Applications in industry & power generation                  | Chalk & board      | CO5 |

  
Signature of Faculty

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22.12.25  
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