# GOVT POLYTECHNIC BOLANGIR

## Department of Mechanical Engineering

## LESSON PLAN: 2025-26

### Name of the Faculty: Rasmi Ranjan Jena (Lecturer Stage-I)

**Subject: Thermal Engineering-II (TH2) (MEPC204)**
**Program**: Diploma in Mechanical Engineering Semester: **4th** Total Contact Hours: **45**
Total Marks: **100** Assessment: Progressive –30, End Term – 70
Credits: 3

**COURSE OBJECTIVES:**

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

1. Explain the working cycle of gas turbines, and the working of Jet and Rocket Engines apart from identifying the fuels used for Jet and Rocket propulsion
2. Compute the work done, enthalpy, internal energy and entropy of steam at given conditions using steam tables and Mollier chart.
3. Distinguish between water tube and fire-tube boilers and explain the function all the mountings and accessories.
4. Calculate Velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart..
5. State the necessity of governing and compounding of a turbine

### UNIT-I: Gas Turbines & Jet Propulsion (10 Classes)

| Class No. | Topic | Sub topics to be Covered | Teaching Aids / Activities | COs |
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| 1 | Introduction to Gas Turbines | Definition of gas turbine,Basic components,Importance and applications | Chalk & board, PPT, real-life examples | CO1 |
| 2 | . Air-Standard Brayton Cycle | Processes of Brayton cycle,Assumptions,Work output & efficiency | Chalk & board, numerical examples | CO1 |
| 3 | Brayton Cycle Diagrams | P–V diagram,T–S diagram,Effect of pressure ratio | Board work, problem solving | CO1 |
| 4 | Classification of Gas Turbines | Open cycle gas turbines,Closed cycle gas turbines,Advantages & disadvantages | Chalk & board | CO1 |
| 5 | Open Cycle Gas Turbine | General layout,Working principle,P–V & T–S diagrams | PPT, Chalk & board | CO1 |
| 6 | Closed Cycle Gas Turbine | General layout,Working principle,P–V & T–S diagrams | PPT, Chalk & board | CO1 |
| 7 | Gas Turbine Comparison & Applications | Gas turbine vs IC engine,Gas turbine vs steam turbine,Applications & limitations | PPT, Chalk & board | CO1 |

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| 8 | Introduction to Jet Propulsion | Principle of jet propulsion,Fuels used for jet propulsion,Applications | PPT, schematic diagram | CO1 |
| 9 | Turbojet & Ramjet Engines | Working of turbojet engine,Ram effect,Working of ramjet engine | PPT, schematic diagram | CO1 |
| 10 | Rocket Propulsion & Comparison | Principle of rocket propulsion,Working of rocket engine,Applications,Jet vs rocket propulsion | PPT, schematic diagram | CO1 |
| **UNIT-II: Properties of Steam (10 Classes)** | | | | |
| 11 | Formation & Uses of Steam | Formation of steam under constant pressure,Industrial uses of steam | PPT, Chalk & board | CO2 |
| 12 | Steam Phases & Regions | Saturated liquid line,Saturated vapor line,Liquid, wet, vapor & superheat regions,Critical point | PPT, Chalk & board | CO2 |
| 13 | Basic Definitions – I | Saturated liquid & saturated vapor,Saturation temperature,Sensible heat & latent heat | Board & charts | CO2 |
| 14 | Basic Definitions – II | Wet steam,Dryness fraction & wetness fraction,Saturated & superheated steam,Degree of superheat | Board & charts | CO2 |
| 15 | Properties of Wet Steam | Enthalpy of wet steam,Internal energy of wet steam,Entropy of wet steam | PPT, Chalk & board | CO2 |
| 16 | Properties of Dry & Superheated Steam | Enthalpy,Internal energy,Entropy of dry & superheated steam | PPT, Chalk & board | CO2 |
| 17 | Steam Processes – I | Isochoric process,Isobaric process,Isothermal process | PPT, Chalk & board | CO2 |
| 18 | Steam Processes – II | Isentropic process,Throttling process,Hyperbolic & polytropic processes | PPT, Chalk & board | CO2 |
| 19 | Simple Numerical Problems | Direct problems on steam tables,Mollier chart-based problems | Chalk & board,Problem solving | CO2 |
| 20 | Steam Calorimeters | Separating calorimeter,Throttling calorimeter,Combined separating & throttling calorimeter,Numerical problems | Chalk & board,Problem solving | CO2 |
| **UNIT-III:Steam Generators / Boilers (8 Classes)** | | | | |

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| 21 | Introduction to Steam Boilers | Function and use of steam boilers,Industrial applications,Basic boiler terminology | PPT, cut-section images | CO3 |
| 22 | Classification of Steam Boilers | Fire tube and water tube boilers,Classification based on pressure, axis, circulation, use,Examples | PPT, Chalk & board | CO3 |
| 23 | Fire Tube Boiler – Cochran Boiler | Construction,Line sketch,Working principle,Advantages & limitations | PPT, Chalk & board | CO3 |
| 24 | Water Tube Boiler – Babcock & Wilcox Boiler | Construction,Line sketch,Working principle,Advantages | PPT, discussion | CO3 |
| 25 | Comparison of Boilers | Water tube vs Fire tube boilers,Applications | PPT, Chalk & board,Models | CO3 |
| 26 | High Pressure Boilers | Lamont boiler – construction & working,Benson boiler – construction & working | Real component / PPT | CO3 |
| 27 | Boiler Mountings | Pressure gauge,Water level indicator,Safety valve (dead weight & spring loaded),Fusible plug,Blow down cock,Stop valve | PPT, Chalk & board | CO3 |
| 28 | Boiler Accessories | Feed pump,Economizer,Super heater,Air preheater,Steam traps & separators | PPT, Chalk & board | CO3 |
| **UNIT-IV: Steam Nozzles (10 Classes)** | | | | |
| 29 | Introduction to Steam Nozzles | Definition of steam nozzle,Function and applications,Types of nozzles | PPT, Chalk & board | CO4 |
| 30 | Flow of Steam Through Nozzle | Steady flow of steam,Energy conversion in nozzle,Assumptions | PPT, Chalk & board | CO4 |
| 31 | Velocity of Steam – Analytical Method | Heat drop concept,Derivation of exit velocity equation,Assumptions | PPT, Chalk & board | CO4 |
| 32 | Velocity of Steam – Mollier Chart | Use of h–s chart,Determination of heat drop,Exit velocity calculation | Chalk & board | CO4 |
| 33 | Discharge Through Nozzle | Mass flow rate,Continuity equation,Effect of pressure | Chalk & board | CO4 |
| 34 | Critical Pressure Ratio | Meaning of critical pressure,Critical pressure ratio for steam,Maximum discharge condition | Chalk & board | CO4 |

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| 35 | Nozzle Area Calculations | Throat area calculation,Exit area calculation,Maximum discharge condition | PPT, Chalk & board | CO4 |
| 36 | Effect of Friction & Supersaturated Flow | Effect of friction on velocity & discharge,Supersaturated flow,Losses in nozzle | PPT, discussion | CO4 |
| 37 | Steam Jet Injector | Construction,Working principle,Applications | PPT, Chalk & board | CO4 |
| 38 | Numerical Problems & Revision | Simple direct problems on nozzle velocity,Discharge & area calculation,Overall revision | PPT, Chalk & board | CO4 |
| **UNIT-V: Steam Turbines (7 Classes)** | | | | |
| 39 | Introduction & Classification of Steam Turbines | Classification of steam turbines with examples,Impulse and reaction turbines,Applications | PPT, Chalk & board | CO5 |
| 40 | Impulse vs Reaction Turbines | Difference between impulse & reaction turbines,Advantages & limitations | PPT, Chalk & board | CO5 |
| 41 | De-Laval Turbine – Principle & Velocity Diagrams | Construction & working principle,Line diagrams,Velocity diagrams | PPT, Chalk & board | CO5 |
| 42 | Performance of Impulse Turbine | Work done,Axial & tangential thrust,Blade, diagram, stage & nozzle efficiency | PPT, Chalk & board | CO5 |
| 43 | Compounding of Steam Turbines | Need for reducing rotor speed,Velocity compounding,Pressure compounding,Pressure-velocity compounding | Chalk & board | CO5 |
| 44 | Parson's Reaction Turbine | Construction & working principle,Line diagrams,Velocity diagrams | Chalk & board | CO5 |
| 45 | Turbine Problems & Governing | Simple problems on impulse & reaction turbines,Blade height problems,Governing: throttle, by-pass & nozzle control | Chalk & board | CO5 |

22/12/25

**Signature of Faculty**

22/12/25

**Signature Of HoD**

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