

# LESSON PLAN

Name of faculty: **MR. JITENDER**

Discipline: **Mechanical Engineering**

Semester: **3rd Semester**

Subject: **Thermodynamics-1**

Lesson Plan Duration: **15 weeks**

Work load (Lecture/ Practical) per week (in hours): **3 Lecture & 4 Practicals**

| Week | Theory      |  | Practicals   |
|------|-------------|--|--|
|      | Day Lecture | Topic(Including Assignment/Test)   |  |
| 1    | 1           | <b>UNIT 1</b><br><b>Fundamental Concepts:</b> Thermodynamic state and system, boundary, surrounding, universe                                      | <b>Practical-1:</b><br><br>Determination of temperature by thermocouple            |
|      | 2           | Thermodynamic systems – closed, open, isolated, adiabatic  |  |
|      | 3           | Homogeneous and heterogeneous, macroscopic and microscopic   |  |
| 2    | 4           | Properties of system – intensive and extensive, thermodynamic equilibrium, Quasi – static process  | <b>Practical-2:</b><br><br>Determination of temperature by pyrometer               |
|      | 5           | Quasi – static process, Zeroth law of thermodynamics   |  |
|      | 6           | Definition of properties like pressure, volume, temperature, enthalpy and internal energy  |  |
| 3    | 7           | <b>Laws of Perfect Gases:</b><br>Definition of gases, explanation of perfect gas laws – Boyle’s law, Charles’s law, Avagadro’s law, Regnault’s law | <b>Practical-3:</b><br><br>Determination of temperature by Infrared thermometer    |
|      | 8           | Universal gas constant, Characteristic gas constants and its derivation.   |  |
|      | 9           | Specific heat at constant pressure, Specific heat at constant volume of a gas  |  |
| 4    | 10          | Derivation of an expression for specific heats with characteristics  | <b>Practical-4:</b><br><br>Study the working of Nestler boiler.                    |
|      | 11          | Simple numerical problems on gas equation  |  |
|      | 12          | <b>UNIT 2</b><br><b>Thermodynamic Processes:</b><br>Types of thermodynamic processes   |  |
| 5    | 13          | Isochoric, isobaric, isothermal, adiabatic, isentropic, polytropic   | <b>Practical-5:</b><br><br>Study of working of high pressure boiler.               |
|      | 14          | Throttling processes, equations representing the processes   |  |
|      | 15          | Derivation of work done, change in internal energy, change in entropy  |  |
| 6    | 16          | Rate of heat transfer for the above process. <b>ASSIGNMENT - 1</b>   | <b>Practical-6:</b><br><br>Demonstration of mountings and accessories on a boiler. |
|      | 17          | <b>1<sup>ST</sup> SESSIONAL TEST</b>   |  |
|      | 18          | Sessional’s doubt session.   |  |

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| 7  | 19 | <b>UNIT 3- Laws of Thermodynamics:</b><br>Laws of conservation of energy, first law of thermodynamics (Joule's experiment) and its limitations, Steady flow energy equation | <b>Practical-7:</b><br>Study of boilers(Through industrial visit)                  |
|    | 20 | Application of steady flow energy equation for turbines, pump, boilers, compressors, nozzles, and evaporators.  |  |
|    | 21 | Heat source and sink, statements of second laws of thermodynamics: Kelvin Planck's statement, Classius statement  |  |
| 8  | 22 | Equivalency of statements, Perpetual motion Machine of first kind second kind   | <b>Practical-8:</b><br>Repeat Practical 1 & 2                                      |
|    | 23 | Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility and concept of entropy.  |  |
|    | 24 | <b>UNIT 4</b><br><b>Steam Generators</b><br>Uses of steam, classification of boilers  |  |
| 9  | 25 | Comparison of fire tube and water tube boilers  | <b>Repeat Practical 8</b><br>Repeat Practical 3 & 4                                |
|    | 26 | Construction and working of Nestler boiler, Babcock & Wilcox Boiler   |  |
|    | 27 | Function of various boiler mounting and accessories   |  |
| 10 | 28 | Introduction to modern boilers – Benson boiler  | <b>VIVA</b>  |
|    | 29 | Doubt session. <b>ASSIGNMENT- 2</b>   |  |
|    | 30 | <b>2<sup>ND</sup> SESSIONAL TEST</b>  |  |
| 11 | 31 | <b>Properties of Steam:</b> Formation of steam and related terms, thermodynamic properties of steam, steam tables   | <b>Practical-9</b><br>Determination of Dryness fraction of steam using calorimeter |
|    | 32 | Sensible heat, latent heat, internal energy of steam, entropy of water, entropy of steam  |  |
|    | 33 | T- S diagrams, Mollier diagram (H – S Chart)  |  |
| 12 | 34 | Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes   | <b>Repeat practical 9</b>  |
|    | 35 | Determination of quality of steam (dryness fraction)  |  |
|    | 36 | <b>UNIT V</b><br><b>Ideal and Real Gases:</b> Concept of ideal gas, enthalpy and specific heat capacities of an ideal gas   |  |
| 13 | 37 | P – V – T surface of an ideal gas, triple point, real gases, Vander-Wall's equation   | <b>Practical-10</b><br>Demonstrate the working of air compressor.                  |
|    | 38 | P – V – T surface of an ideal gas, triple point, real gases, Vander-Wall's equation   |  |
|    | 39 | <b>Air Compressors:</b><br>Functions of air compressor – uses of compressed air, type of air compressors  |  |
| 14 | 40 | Type of air compressors   | <b>Repeat practical no 10</b>  |
|    | 41 | Doubt session. <b>ASSIGNMENT - 3</b>  |  |
|    | 42 | <b>3<sup>RD</sup> SESSIONAL TEST</b>  |  |

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| 15 | 43 | Sessional's doubt session. | <b>VIVA</b> |
|    | 44 | Revision                   |             |
|    | 45 | Revision                   |             |