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| Course Code | Course Name | Credits |
| MEC305 | Thermodynamics | 03 |
| Module | Detailed contents | Hrs |
| 1 | **Basic Concepts :**  Thermodynamics system and types, Macroscopic and Microscopic approach, Thermodynamic properties of the system, state, path, processand cycle, Point and Path functions, Quasi-static process & Equilibrium, Zeroth law of thermodynamics, Characteristic gas equation, Concept of Internal energy, Enthalpy, Heat and Work. Concept of PdV work.  **First Law of Thermodynamics:**  Statement & Equation, First law for Cyclic process (Joule’s experiment), Perpetual Motion Machine of the First Kind, Application of first law to non- flow systems (Ideal gas processes with numerical) | 07 |
| 2 | **Second Law of Thermodynamics:**  Limitation of the first law of thermodynamics, Thermal reservoir, Concept of heat engine, Heat pump and Refrigerator, Statement of the second law of thermodynamics, Reversible and irreversible Process, Causes of irreversibility, Perpetual Motion Machine of the second kind,Carnotcycle, Carnot theorem.  **Entropy:** Clausiustheorem, Entropy is property of a system, Temperature-Entropy diagram, Clausius inequality, Increase of entropy principle, T ds relations, Entropy change During a process. | 08 |
| 3 | **Availability:**  Highgradeandlow-gradeenergy,AvailableandUnavailableenergy,DeadState, Useful work, Irreversibility, Availability of closed system& steady flow process, Helmholtz & Gibbs function  **Thermodynamic Relations:**  Maxwell relations, Clausis-Clapeyron Equation, Mayer relation, Joule- Thomson coefficient (Only Theory) | 05 |
| 4 | **Properties of Pure Substance:**  Advantages and applications of steam, Phase change process of water, Saturation pressure and temperature, Terminology associated with steam, Different types of steam.Property diagram: T-v diagram, p-v diagram, p-T diagram, Critical and triple point, T-s and an h-s diagram for water, Calculation of various properties of wet, dry and superheated steam using the steam table and Mollier chart**.**  **Vapour Power cycle:**  Principal components of a simple steam power plant, Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, Mean temperature of heat addition, Reheat Rankine Cycle. | 07 |
| 5 | **Gas Power cycles:**  Nomenclature of a reciprocating engine, Mean effective pressure, AssumptionsofairStandardCycle,Ottocycle,DieselCycleandDualcycle, Comparison of Otto and Diesel cycle for same compression ratio,BraytonCycle.  Sterling Cycle, Ericsson Cycle, Lenoir cycle, and Atkinsoncycle (Only theory). | 6 |
| 6 | **Compressible Fluid flow:**  Propagation of sound waves through compressible fluids, Sonic velocity and Mach number; Stagnation properties, Application of continuity, momentum and energy equations for steady-state conditions; Steady flow through the nozzle, Isentropic flow through ducts of varying cross-sectional area, Effect of varying back pressure on nozzle performance, Critical pressure ratio. | 6 |

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| **CO-PO**  **Mapping** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | - | 2 | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| **CO6** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - |

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| **FINAL CO** | **=** | **(0.8\* Direct) + (0.2\* Indirect)** |

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| **Direct** | **CO1** | (0.6\*Test) +(0.4\*Univ Exam) |
| **CO2** | (0.6\*Test) +(0.4\*Univ Exam) |
| **CO3** | (0.6\*Test) +(0.4\*Univ Exam) |
| **CO4** | (0.6\*Test) +(0.4\*Univ Exam) |
| **CO5** | (0.6\*Test) +(0.4\*Univ Exam) |
| **CO6** | (0.6\*Test) +(0.4\*Univ Exam) |

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| **Indirect** | **CO1** | (1\*Exit Survey) |
| **CO2** | (1\*Exit Survey) |
| **CO3** | (1\*Exit Survey) |
| **CO4** | (1\*Exit Survey) |
| **CO5** | (1\*Exit Survey) |
| **CO6** | (1\*Exit Survey) |

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| **Co No.** | **Course Outcomes** |
| **CO1** | Demonstrate application of the laws of thermodynamics to a wide range of systems. |
| **CO2** | Compute heat and work interactions in thermodynamic systems |
| **CO3** | Demonstrate the interrelations between thermodynamic functions to solve practical problems. |
| **CO4** | Compute thermodynamic interactions using the steam table and Mollier chart |
| **CO5** | Compute efficiencies of heat engines, power cycles. |
| **CO6** | Apply the fundamentals of compressible fluid flow to the relevant systems |