

Registration No.:

--	--	--	--	--	--	--	--	--	--

Total Number of Pages: 02

Course: B.Tech
Sub_Code: RBM1B001

1st / 3rd Semester Back Examination: 2025-26

SUBJECT: Basic Mechanical Engineering

BRANCH(S): CIVIL, CSE, CSEAIML, CSEDS, CSIT, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E,
ETC, MANUTECH, MINING, PLASTIC

Time: 3 Hours

Max Marks: 100

Q.Code: U690

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

- Q1** Answer the following questions: (2 x 10)
- What do you mean by thermal equilibrium and mechanical equilibrium?
 - State the first law of thermodynamics applied for a process.
 - What is free expansion?
 - Write an expression for COP of a refrigerator.
 - State the different modes of heat transfer.
 - Find Characteristic gas constant value for Nitrogen.
 - How Clutches are different from brakes?
 - What is Robot Anatomy?
 - Define buoyancy.
 - What is pressure? Mention the different units of pressure.

Part-II

- Q2** Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)
- Derive the expression for the pdv work in case of an adiabatic process.
 - Draw T-S diagram of a Carnot cycle and explain the process.
 - 500 kg of fish at 10 °C are to be frozen and stored at -10 °C. the specific heat of fish above freezing point is 3.182 kJ/kgK and below freezing point is 1.717 kJ/kgK. The freezing point of fish is 0 °C, and the latent heat of fusion is 234.5 kJ/kg. How much heat must be removed to cool fish, and what percentage of this is latent heat?
 - Establish the equivalence of Kelvin-Planck and Clausius statements.
 - Using an engine of 30 % thermal efficiency to drive a refrigerator having a Cop of 5, What is the heat input into the engine for each MJ removed from the cold body by the refrigerator?
 - Show that for an ideal gas, the slope of the constant volume line on the T-s Diagram is more than that of the constant pressure line.
 - Explain the principle and working of vapour compression refrigerator system.
 - Explain the working of steam power plant and give its layout.

- i) Explain the working principle of reciprocating compressor with a neat sketch.
- j) Explain the different types of power transmission drives.
- k) State and explain Clausius' theorem.
- l) Explain the energy losses due to flow in pipes.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) A heat pump working on the Carnot cycle takes in heat from a reservoir at 5 °C and delivers heat to a reservoir at 60 °C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840 °C and rejects heat to a reservoir at 60 °C. The reversible heat engine also drives a machine that absorbs 30 kW. If the heat pump extracts 17 kJ/s from the 5 °C reservoir, determine (10)
- I) the rate of heat supply from the 840 °C source,
 - II) the rate of heat rejects on to the 60 °C sink.
- b) Explain the working of a cone clutch in an automobile. (6)
- Q4** a) A cylinder with a movable piston contains water vapour with 50 % dryness fraction. Now the system absorbs heat at constant pressure such that its dryness fraction increases to 90 %. What is the total heat transferred (in kJ/kg) to the system of water vapour? (8)
(Enthalpy of saturated liquid and saturated vapour at corresponding pressure are 504.7 kJ/kg & 2706.7 kJ/kg respectively)
- b) Define Entropy principle. Show that Entropy is a property of a system. (8)
- Q5** a) Explain in detail with line diagram the working of a four-stroke petrol engine. (8)
- b) Explain the method of pointer and scale for torque measurement. (8)
- Q6** a) 0.5 kg of air is compressed reversibly and adiabatically from 80 KPa, 60 °C to 0.4 MPa, and is then expanded at constant pressure to the original volume. Sketch these processes on the p-v and t-s planes. Compute the heat transfer and work transfer for the whole path. (8)
- b) Explain different types of Robot Configuration. (8)