Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Sem-III (Mechanical Engineering)

CBCS Regular Examination/ Nov.-Dec. -2014

Engineering Thermodynamics – (2ME305)

Time: 3 Hours **Total Marks: 70**

Instruction:
1. Attempt All The Questions.
2. Assume Suitable Data if not giving.
3. Be Precise with your Answer.
4. Don't write anything on question paper.
5. Use of Steam table is allowed.

SECTION - I

Quest.1 **(A)** What is Thermodynamics? Describe Thermodynamic Systems and Properties with suitable examples. **[6]**

(B) Explain Zeroth and First Law of Thermodynamics with Suitable Examples. **[6]**

OR

Quest.1 **(A)** Explain Enthalpy and prove that during Throttling Process Enthalpy remains Constant. **[6]**

(B) A cylinder contains 0.45 m^3 of a gas at 1×10^5 N/m^2 and 80°C. The gas is compressed to a volume of 0.13 m^3, the final pressure being 5×10^5 N/m^2. Determine : **[6]**
(i) The mass of gas
(ii) The value of index 'n' for compression
(iii) The increase in internal energy of the gas
(iv) The heat received or rejected by the gas during compression.
Take $\gamma = 1.4$, $R = 294.2$ J/kg°

Quest.2 **(A)** Write Clausius and Kelvin-Planck Statement. Explain Clausius Inequality. **[5]**

(B) A reversible heat engine operates between two reservoirs at temperatures 700°C and 50°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 50°C and – 25°C. The heat transfer to the engine is 2500 kJ and the net work output of the combined engine refrigerator plant is 400 kJ. **[6]**
(i) Determine heat transfer to the refrigerant and net heat transfer to the reservoir at 50°C
(ii) what if, the efficiency of the heat engine and the C.O.P. of the refrigerator are each 45 Percent of their maximum possible values.

OR

Quest.2 **(A)** A house requires 2×10^5 kJ/h for heating in winter. Heat pump is used to absorb heat from cold air outside in winter and send heat to the house. Work required to operate the heat pump is 3×10^4 kJ/h. Determine : **[5]**
(i) Heat abstracted from outside
(ii) Co-efficient of performance.

(B) What is the Limitations of First Law of Thermodynamics? Describe Heat Pump, Refrigerator and Heat Engine. Derive the expression for C.O.P of Heat Engine. **[6]**

Quest.3 **(A)** What are Available and Unavailable Energy? Explain Decrease in Available Energy when Heat is Transferred through a Finite Temperature Difference. **[6]**

(B) What is Entropy and Explain Third Law of Thermodynamics? Derive the Expression for change in Entropy for Isobaric Process. **[6]**

SECTION - II

Quest.4 (A) What is Pure Substance? Explain Phase Change of Water with figure and P-V diagram. [6]

(B) Derive All Four Maxwell relations. [6]

OR

Quest.4 (A) A pressure cooker contains 1.5 kg of saturated steam at 5 bar. Find the quantity of heat which must be rejected so as to reduce the quality to 60% dry. Determine the pressure and temperature of the steam at the new state. [6]

(B) Derive both Entropy Equations (Tds Equations). [6]

Quest.5 (A) Explain Rankine Cycle with diagram and derive the expression for thermal efficiency. [5]

(B) The following data refer to a simple stea[illegible]lant : [6]

S.No.	Location	Pressure	Quality / Temp.
1	Inlet to Turbine	[illegible]MPa (60 bar)	380^{0}C
2	Exit from turbi[illegible]	[illegible]0 kPa (0.1 bar)	0.9
3	Exit from Co[illegible]	9 kPa (0.09 bar)	Saturated Liquid
4	Exit from Pu[illegible]	7 MPa (70 bar)	----------
5	Exit from Boil[illegible]	6.5 MPa (65 bar)	400^{0}C
	Rate of steam fl[illegible] kg/h.		

Calculate :

(i) Power output of the turb[illegible].

(ii) Heat transfer per hour in the boiler and condenser separately.

(iii) Mass of cooling water circulated per hour in the condenser. Inlet temperature of Cooling water 20°C and 30°C at exit from the condenser.

OR

Quest.5 (A) Draw P-V and T-S diagrams for following Cycles: [5]

(i) Carnot Cycle (ii) Stirling Cycle (iii) Dual Cycle

(iv) Brayton Cycle (v) Atkinson Cycle

(B) Explain Carnot Cycle with figure and draw P-V, T-S diagrams. What are the limitations of this cycle? [6]

An inventor claims, a heat cycle will develop 0.4 kW for a heat addition of 32.5 kJ/min. The temperature of heat source is 1990 K and sink is 850 K. Is his claim possible?

Quest.6 (A) Explain Diesel Cycle with P-V and T-S diagrams. Derive the Expression for Thermal Efficiency for the same. [6]

(B) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27°C. The amount of heat added to the air per cycle is 1500 kJ/kg. [6]

(i) Determine the pressures and temperatures at all points of the air standard Otto cycle.

(ii) Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8 : 1

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