Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- III (MECHANICAL ENGINEERING)

CBCS REGULAR EXAMINATION– NOV-DEC 2016

2ME303: Engineering Thermodynamics

TIME: 3 HRS **TOTAL MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.
(4) Use of Steam Table is allowed.

SECTION: I

Q.1 (a) What is thermodynamics? Explain thermodynamic properties and systems along with figure. **(5)**

(b) Explain Zeroth law of thermodynamics with any practical instrument working on it. **(5)**

OR

Q.1 (a) Derive an expression for heat transfer for reversible Polytropic processes also draw it on PV diagram. **(5)**

(b) Air at 1.02 bar, 22^0C initially occupies a cylinder volume of $0.015m^3$ is compressed reversibly and adiabatically by a piston to a pressure of 6.8 bar. Calculate: **(5)**
(i) Final temperature (ii) Final volume (iii) Work done.

Q.2 (a) Write Kelvin-Plank and Clausius statements. What is PMM –II? **(5)**

(b) An ice plant working on a reversed Carnot cycle heat pump produces 15 tonnes of ice per Day. The ice is formed from water at 0^0C and the formed ice is maintained at 0^0C. the heat is rejected to the atmosphere at 25^0C. the heat pump used to run the ice plant is coupled to a Carnot engine which absorbs heat from a source which is maintained at 220^0C Burning liquid fuel with calorific value of 44500 kJ/kg and rejects the heat to the atmosphere. **(5)**
Determine:
(i) Power Developed per hour (ii) fuel consumed per hour
Take enthalpy of fusion of ice = 334.5 kJ/kg

OR

Q.2 (a) Explain Entropy with example. Derive an expression for change in entropy for isobaric process. **(5)**

(b) A fluid undergoes a reversible adiabatic compression from 4 bar, 0.3 m^3 to 0.008 m^3 according to the law, $pv^{1.25}$ = Constant. Determine: **(5)**
(i) Change in Enthalpy (ii) Change in Internal Energy (iii) Change in Entropy
(iv) Heat Transfer (v) Work Transfer

Q.3 Attempt any **two** of the following.

(a) Explain Exergy with example along with decrease in available energy when heat is transferred through a finite temperature difference. **(5)**

(b) A system at 500K receives 7200 kJ/min from a source at 1000K. The temperature of atmosphere is 300 K. assuming that temperature of a system and source remains constant during heat transfer. Find out: **(5)**
(i) the entropy produced during heat transfer
(ii) the decrease in available after heat transfer
Also show it on TS diagram.

(c) Differentiate open and close thermodynamic systems. Derive an expression for SFEE. **(5)**

SECTION: II

Q.4 (a) Write a short note on followings and also draw it on PV diagram. (5)
(i) saturated Liquid (ii) saturated Vapour (iii) wet Region
(iv) sub-cooled liquid (v) superheated steam

(b) 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 quantity to 60% dry. Determine the pressure and temperature of the steam at the new state. (5)

OR

Q.4 (a) Explain and derive adiabatic mixing of perfect gases. (5)

(b) A vessel of 0.35 m^3 capacity contains 0.4 kg of carbon monoxide and 1 kg of air at 20^0C. calculate: (5)
(i) the partial pressure of each constituents
(ii) the total pressure in the vessel
Take gravimetric analysis of air may be taken as 23.3% oxygen and 76.7% nitrogen.

Q.5 (a) Derive all Maxwell's equations. (5)

(b) Derive first and second TdS equations. (5)

OR

Q.5 (a) Over which cycle a thermal power plant works? Do the energy analyses of that cycle along with draw it on PV and TS diagrams. (5)

(b) In a thermal power plant, steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine: (5)
(i) pump work (ii) turbine work (iii) efficiency of cycle
(iv) Condenser heat flow rate (v) dryness fraction at the end of the expansion.
Assume flow rate of 9.5 kg/s.

Q.6 Attempt any two of the following.

(a) On which cycle petrol engine works? Derive an expression for that cycle also draws it on PV and TS diagram. (5)

(b) Draw the following cycles on PV and TS diagrams: (5)
(i) Stirling Cycle (ii) Ericsson Cycle (iii) Atkinson Cycle
(iv) Diesel Cycle (v) Carnot Cycle

(c) Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 14, if the fuel cut-off is delayed from 5% to 8%. (5)

----------END OF PAPER----------