Seat No:_____

GANPAT UNIVERSITY

B.Tech. Sem. III (Mechanical Engineering)

CBCS (NEW) Regular Examination November – December -2015

2ME303 – Engineering Thermodynamics

Times: 3 Hours Total Marks: 60

Instruction:

(I) Attempt all questions.
(II) Don't write anything on the question paper.
(III) Allow steam table.
(IV) Figures on right indicate full marks.

Section-I

Que.1. **(a)** Define 'Heat' and bring out similarities and dissimilarities between heat and work. **(4)**

(b) A gas contained in a cylinder fitted with a piston loaded with a small number of weight is at 1.3 bar pressure and 0.03 m^3 volume the gas is heated until the volume increase to 0.1 m^3 calculate the work done by the gas in the following process **(6)**

(i) Pressure remain constant (ii)Temperature remain constant
(ii) $PV^{1.3}=C$ during the process show the process on P-V diagram.

OR

Que.1. **(a)** Discuss the following term with examples **(6)**

(i) Intensive and Extensive properties. (ii) Thermodynamics and Mechanical equilibrium. (iii) Closed and Open system.

(b) Simplify SFEE equation for a case of Turbine and Heat exchanger **(4)**

Que.2. **(a)** Define Kelvin –Plank statement, Clausius statement of II^{nd} law of thermodynamics and show that they are equivalent. **(4)**

(b) A perfect reversed heat engine is used for making ice at -5^0C from water available at 25^0C. The temperature of freezing mixture is -10^0C. Calculate the quantity of ice formed per kWh. For ice: specific heat = 2.1 kJ/kg K and Latent heat = 335 kJ/kg **(6)**

OR

Que.2. **(a)** Derive the Maxwell relations and explain their importance in thermodynamics. **(5)**

(b) Derive Claperyon's equation. What are its uses and limitations? **(5)**

Que.3. **(a)** Sketch the T-P phase diagram for water. Make on it the following solid region, liquid region, vapour phase, triple point and critical point **(5)**

(b) With neat sketches indicate various parameters on typical T-s and H-s diagrams. **(5)**

Section-II

Que.4. (a) Derive the air standard efficiency of diesel engine and explain the effect of Cut-off ratio on performance of engine. **(4)**

(b) An air standard Otto cycle is designed to operate with the following data **(6)**
Maximum cycle pressure and temperature : 5 MPa and 2250 K
Minimum cycle pressure and temperature : 0.1 MPa and 300 K
Determine the net work output per unit mass of working fluid and the thermal efficiency.

OR

Que.4. (a) For the same compression ratio and heat input, which cycle are more efficient Otto, Diesel and Dual? Explain with P-V and T-s diagrams **(6)**

(b) Explain the simple Brayton cycle. **(4)**

Que.5. (a) Derive Clausius inequality for a cycle. **(4)**

(b) A reversible heat engine working between two thermal reservoirs at 875 K and 315 K drives a reversible refrigerator which operates between the same 315 K reservoir and a reservoir at 260 K. The engine is supplied 2000 kJ of heat and the net work output from the composite system is 350 kJ. Make calculations for the heat transfer to the refrigerator and the net heat interaction with the reservoir at 315 K temperature. **(6)**

OR

Que.5. (a) Define dead state and what do you understand by exergy and anergy? **(4)**

(b) In counter flow heat exchanger 0.25 kg/s of water are heated from 30^0C to 60^0C by hot gases which enter at 180^0C and leave at 80^0C make calculations for the mass of gases, heat transferred and loss of available energy due to this heat transfer. Take Cp for gases = 1.08 kJ/kg K and ambient temperature = 27^0C. **(6)**

Que.6. (a) Describe the classic paddle wheel experiment performed by Joule. What conclusion was drawn based on the experimental observations? **(6)**

(b) State the first law of thermodynamics and derive the energy equation for a non flow process **(4)**

End of paper