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(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2012250 Roll No. | | | | | | | | | | |

B.TECH.

Regular Theory Examination (Odd Sem - III), 2016-17

THERMODYNAMICS

Time : 3 Hours *Max. Marks : 100*

SECTION - A

1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)**

   a) List any five physical properties of matter which can be used for measurement of temperature.

   b) How does a homogeneous system differ from a heterogeneous system?

   c) Write Boyle's law and Charle's Law.

d) State Carnot theorem.

e) Compare heat pump and refrigerator.

f) State third law of thermodynamics.

g) Is the availability function same for a non-flow and a flow process? Justify.

h) What advantages are obtained if superheated steam is used in steam prime movers.?

i) Define dryness fraction of steam.

j) Define brake power in an IC Engine.

SECTION - B

Attempt any 5 questions from this section.(5×10=50)

2. In a gas turbine unit, the gases flow through the turbine is 15 kg/s and the power developed by the turbine is 12000 kW. The enthalpies of gases at the inlet and outlet are

1260 kJ/kg and 400 kJ/kg respectively, and the velocity of gases at the inlet and outlet are 50 m/s and 110 m/s respectively. Calculate:

i) The rate at which heat is rejected to the turbine, and

ii) The area of the inlet pipe given that the specific volume of the gases at the inlet is 0.45 m^3/kg.

3. 3 kg of air at 1.5 bar pressure and 77°c temperature at state 1 is compressed polytropically to state 2 at pressure 7.5 bar, index of compression being 1.2. It is then cooled at constant temperature to its original state 1 . Find the net work done and heat transferred.

4. Explain the entropy principle and apply it to a closed system.

5. Two kg of air at 500 kPa, 80°C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings which is 100 kPa, 5°C. For this process determine.

a) The maximum work

b) The change in availability

c) The irreversibility

6. Show that violation of Kelvin Planck statement of second law of thermodynamics implies a violation of Clausius statement.

7. Draw the p-T diagram of pure substance and explain its various regions of the diagram in details?

8. Discuss the effect of pressure of steam at inlet to turbine, temperature at inlet to turbine and pressure at exit from turbine upon Rankine cycle performance.

9. Explain the following:

a) Brake specific fuel consumption,

b) Brake mean effective pressure,

c) Mechanical efficiency,

d) Brake thermal efficiency,

e) Indicated thermal efficiency.

SECTION - C

Attempt any 2 questions from this section

(2×15=30)

10. a) Compare SI engines with CI engines **(8)**

b) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. **(7)**

11. a) Derive the steady flow energy equation applied to compressor. **(7)**

b) Throttling calorimeter has steam entering to it at 10MPa and coming out of it at 0.05 MPa and 100°C. Determine dryness fraction of steam. **(8)**

12. Three reversible engines of Carnot type are operating in series as shown between the limiting temperatures of 1100 K and 300 K. Determine the intermediate temperatures if the work output from engines is in proportion of 3 : 2 :1.