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**NME - 303** 

(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.

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- 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.
- i) 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  $0.45 \text{ m}^3/\text{kg}$ .
- 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,

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- c) Mechanical efficiency,
- d) Brake thermal efficiency,
- e) Indicated thermal efficiency.

## **SECTION - C**

## Attempt any 2 questions from this section

 $(2 \times 15 = 30)$ 

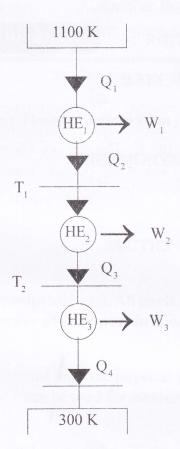
#### **10.** a) Compare SI engines with CI engines (8)

- 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)

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- 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.



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