Code : 021101

B.Tech 1st Semester Exam., 2015

ELEMENTS OF MECHANICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option/Fill in the blanks of the following (any *seven*) : 2×7=14

(a) Work done in a free expansion process is

(i) positive

(ii) negative

(iii) zero

(iv) maximum

(v) minimum

(b) Entropy change depends on

(i) heat transfer

(ii) mass transfer

(iii) change of temperature

(iv) thermodynamic state

(v) change of pressure and volume

(c) In case of gas turbine, the gaseous fuel consumption guarantees are based on

(i) high heat value

(ii) low heat value

(iii) net calorific value

(iv) middle heat value

(v) calorific value

(d) Mach number is defined as _____.

(e) Equivalent evaporation of a boiler is defined as _____.

(f) Cycle efficiency of a modern thermal power plant is approximately

(i) 29%

(ii) 60%

(iii) 80%

(iv) 44%

(v) None of the above

(a) For supersonic flow, the converging duct is

(i) nozzle

(ii) diffuser

(iii) venture

(iv) duct in which velocity remains constant

(b) The ideal refrigeration cycle in aircraft is

(i) vapour compression cycle

(ii) vapour absorption cycle

(iii) steam jet refrigeration

(iv) reversed Brayton cycle

(c) The working substance in Rankine cycle

(i) is gas

(ii) is vapour

(iii) can be gas or vapour

(d) The critical pressure of the steam is

(i) 10 bar

(ii) 221·1 bar

(iii) 100 bar

(iv) 2212 bar

2. (a) What is wind power plant? Define the types of windmill. 7

(b) Explain the construction and working of a Janata Model Gobar Gas Plant. 7

3. (a) A fluid system undergoes a non-flow frictionless process following the pressure-volume relation as $p = 5/v + 1 \cdot 5$, where p is in bar and v is in m^3. During the process, the volume changes from $0 \cdot 15\ m^3$ and the system rejects 45 kJ of heat. Determine the—

(i) change in internal energy;

(ii) change in enthalpy. 7

(b) 1 kg of steam at 8 bar, entropy 6·55 kJ/kg-K, is heated reversibly at constant pressure until the temperature is 200 °C. Calculate the heat supplied and show on a T-S diagram the area which represents the heat flow. 7

4. (a) Explain boiler mountings and accessories. Sketch any two. 7

(b) Enumerate the factors which should be considered while selecting a boiler. 7

5. (a) A 4-cylinder two-stroke cycle petrol engine develops 30 kW at 2500 r.p.m. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder of stroke to bore ratio 1·5. Also calculate the fuel consumption of the engine, if brake efficiency is 28%. The calorific value is in J/kg. 8

(b) What are the two basic types of internal combustion engines? What are the fundamental differences between the two? 6

6. (a) Describe the working principle of thermal power plant with a neat sketch. 7

(b) Describe the working principle of nuclear power plant with a neat sketch. 7

7. (a) Differentiate clearly between open and closed air refrigeration systems. 7

(b) Enumerate the main parts of the equipment in the air-conditioning cycle. 7

8. (a) Name various ores of iron and explain the process of manufacturing pig iron from them. 7

(b) Compare the construction and working of blast furnace and cupola. Explain the method of operation of cupola. 7

9. (a) Compare recrystallization in steel caused by an allotropic change and recrystallization due to cold working. 7

(b) Draw iron-carbon equilibrium diagram and show their salient features. 7

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