Code : 021201

B.Tech 2nd 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 (any *seven*) : 2×7=14

(a) As differentials, heat and work would be described mathematically as

(i) inexact

(ii) exact

(iii) discontinuous

(iv) point function

(b) The first law of thermodynamics refers to conservation of

(i) mass

(ii) momentum

(iii) energy

(iv) heat

(c) Heat transferred in constant pressure process is equal to

(i) work done

(ii) change in enthalpy

(iii) change in internal energy

(iv) change in entropy

(d) The heat energy released by the complete fusion of 1 kg of U^{235} is equal to the heat energy obtained by burning of high grade coal of

(i) 4000 tons

(ii) 2000 tons

(iii) 4500 tons

(iv) 1000 tons

(e) The power developed inside the cylinder of an engine is called

(i) indicated power

(ii) horsepower

(iii) brake power

(iv) friction power

(f) Heat addition to water in a boiler takes place at

(i) constant temperature

(ii) constant volume

(iii) constant entropy

(iv) constant pressure

(g) How many degrees the crankshaft rotates in one complete cycle of four-stroke engine?

(i) 90°

(ii) 180°

(iii) 360°

(iv) 720°

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(h) The evaporator coil in the refrigerating chamber

(i) rejects the heat

(ii) absorbs the heat

(iii) compresses the refrigerant

(iv) expands the refrigerant

(i) The percentage of carbon in cast iron varies between

(i) 0·02–0·8

(ii) 0·8–2·0

(iii) 2·0–4·5

(iv) 4·5–6·67

(j) The ability of a material to resist deformation under the action of external load is called

(i) strength

(ii) hardness

(iii) toughness

(iv) brittleness

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2. *(a)* Distinguish between conventional and non-conventional sources of energy. Give suitable examples. 7

(b) What are the advantages and disadvantages of liquid fuels over solid fuels? 7

3. *(a)* Define the following : 6

(i) Closed, open and isolated systems

(ii) Intensive and extensive property

(b) Air weighing 2·5 kg, occupying 0·8 m^3, had a temperature of 25 °C. It was then heated at constant volume until its temperature becomes 205 °C. How much heat was transferred to the air and what was its final pressure? [$C_V = 0·719$ kJ/kg K, $R = 0·287$ kJ/kg K] 8

4. *(a)* What are the special features of good boilers? 5

(b) Why are water-tube boilers more preferred for steam power plants? 4

(c) Explain the working of economizer with suitable sketch. 5

5. *(a)* What are the advantages of steam turbine over steam engine? 5

(b) Why is steam turbine compounded? Give reasons. 5

(c) Differentiate between open-cycle gas turbine and closed-cycle gas turbine. 4

6. *(a)* Differentiate between SI engine and CI engine. 6

(b) Derive an expression for air standard efficiency of Brayton cycle. 8

7. *(a)* Explain with a neat sketch the working of hydel power plant. What are the functions of surge tank and draft tube? 10

(b) What are the functions of moderators and control rod in nuclear power plant? 4

8. *(a)* Define the following : 6

(i) Refrigeration effect

(ii) Tonne of refrigeration

(iii) COP

(b) Explain the working of vapour absorption system of refrigeration indicating all components. 8

9. *(a)* Explain the following properties of material : 8

   (i) Ductility

   (ii) Hardness

   (iii) Toughness

   (iv) Resilience

   (b) Explain the heat treatment process annealing. What are its advantages? 6

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