Code : 021201

2012

ELEMENTS OF MECHANICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

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

*(iii) Attempt any **FIVE** questions.*

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

1. Fill in the blanks/Choose the correct answer (any *seven*) :

(a) Main demerits of non-conventional energy sources are ——

(b) If temperature in degree Celsius is 37°, then the equivalent temperature in Fahrenheit will be

(i) 98·6

(ii) 99

(iii) 98·3

(iv) 98

(c) Which of the following sets has all the properties as point functions?

(i) Pressure, temperature, heat

(ii) Entropy, volume, work

(iii) Temperature, enthalpy, internal energy

(iv) Heat, work, enthalpy

(d) Change in internal energy in a reversible process occurring in closed system will be equal to heat transferred, if the process occurs at constant

(i) pressure

(ii) volume

(iii) temperature

(iv) enthalpy

(e) —— and —— are the examples of fire-tube boilers.

(f) The compression ratio of a petrol engine and a diesel engine lies in the range of —— to —— and —— to —— respectively.

(g) The evaporator coil in the refrigerating system

(i) compresses the refrigerant

(ii) expands the refrigerant

(iii) rejects the heat

(iv) absorbs the heat

The life of hydel power plant is ____ years and that of thermal power plant is ____ years.

The function of cooling tower in thermal power plant is to reduce

(i) temperature of feed water

(ii) temperature of circulating water

(iii) temperature of steam

(iv) temperature of air

The ability of a material to absorb energy up to elastic limit is called ____ and up to rupture —

2. (a) What is meant by renewable and non-renewable energy sources? Give suitable examples of each.

(b) What is the origin of biomass energy? What are the main advantages and disadvantages of it?

(c) What are the most favourable sites for installing wind turbines?

3. (a) Define the following terms :

(i) Thermodynamic equilibrium

(ii) Quasi-static process

(iii) Internal energy

(b) 0·2 kg of air is compressed by following the process of isothermal from 40 kPa 30°C to 0·2 MPa and is expanded at constant pressure to the original volume. Sketch the process on p-v and T-S plots. Compute net work to be obtained and also the heat transfer.

4. (a) Define boiler according to IBR.

(b) Classify mountings into safety fittings and control fittings.

(c) Describe the functions of chimney in a boiler.

5. (a) What are the advantages of steam turbine over reciprocating engines?

(b) Write the functions of the following :

(i) Nozzle

(ii) Moving blade

(iii) Guide blades in steam turbine

(c) Why is gas turbine used in aviation?

6. (a) Draw the diesel cycle on p-v and T-S coordinates and explain its functioning.

(b) Derive an expression for the air standard efficiency of a Brayton cycle in terms of pressure ratio.

7. (a) Draw the layout of simple thermal power plant and explain the function of its various parts.

(b) What are the advantages and disadvantages of nuclear power plant?

8. (a) Differentiate between vapour compression refrigeration and vapour absorption refrigeration.

(b) With a neat sketch, explain the working of a room airconditioner.

9. (a) What are different classes of cast iron? What are their properties and applications?

(b) What is tempering? What are its objectives?

