Code : 021101

B.Tech 1st Semester Exam., 2017

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) Which of the following statements is wrong?

(i) Locomotive boiler is a water-tube boiler.

(ii) Water-tube boilers are internally fired.

(iii) La-mont boiler is a low pressure water-tube boiler.

(iv) All of the above

(b) Which of the following is considered to be superior quality coal for power plants?

(i) Coke

(ii) Bituminous coal

(iii) Pulverised coal

(iv) Lignite

(c) Which of the following methods is adopted for governing of steam turbines in a power plant?

(i) Throttle governing

(ii) Hit and miss governing

(iii) Blow-off in boiler

(iv) Speed control

(d) Otto cycle efficiency is higher than Diesel cycle efficiency for the same compression ratio and heat input because in Otto cycle

(i) maximum temperature is higher

(ii) combustion is at constant volume

(iii) expansion and compression are isentropic

(iv) heat rejection is lower

(e) Any change that a system undergoes from one equilibrium state to another is known as

(i) path

(ii) process

(iii) cycle

(iv) All of the above

(f) The vapour compression refrigerator employs which of the following cycles?

(i) Rankine

(ii) Carnot

(iii) Reversed Rankine

(iv) Reversed Carnot

(g) The isentropic enthalpy drop in moving blade is two-third of the isentropic enthalpy drop in fixed blades of a turbine. The degree of reaction will be

(i) 0·56

(ii) 0·4

(iii) 0·5

(iv) 0·67

(h) For ammonia refrigerating systems, the tubes of a shell and tube condenser are made of

(i) aluminium

(ii) brass

(iii) steel

(iv) copper

(i) A turbine is said to have an axial discharge when the steam leaves the blade tip at ___ to the direction of the blade motion.

(i) 90°

(ii) 180°

(iii) 60°

(iv) 270°

(j) Cold work components are generally subjected to

(i) annealing

(ii) hardening

(iii) tempering

(iv) short peening

2. *(a)* What are the advantages and disadvantages in using the following energy resources? 7

(i) Solar energy

(ii) Hydropower

(iii) Wind energy

(iv) Biomass energy

(b) Derive the characteristics equation of a perfect gas. 7

3. *(a)* Explain with a neat sketch the Babcock and Wilcox water-tube boiler. Show path of the gases and water in it. 7

(b) A sample of wet steam at a pressure of 25 bar absolute has dryness fraction 0·80. Determine its enthalpy and internal energy. 7

4. *(a)* Derive an equation for work done in case of single stage single-acting reciprocating air compressor neglecting clearance. 7

(b) What do you understand by mechanical and thermal efficiency? A steam plant uses 3 tonnes of coal/hr. The steam is fed to turbine the output of which is

4 MW. The calorific value of the coal is 30 MJ/kg. Calculate the thermal efficiency of the plant. 7

5. *(a)* Explain strengh, hardness and resilience. 7

(b) Give the Kelvin-Planck statement and the Clausius statement of second law of thermodynamics. Show that they are equivalent. 7

6. *(a)* What is prime mover? How are they classified? 7

(b) What do you mean by boiler mountings and accessories? List at least five boiler mountings and explain any one with neat sketch. 7

7. *(a)* Derive the expression for the efficiency of the Carnot cycle. 7

(b) In an ideal Diesel cycle, the temperatures at the beginning and at the end of compression are 57 °C and 603 °C. The temperatures at the beginning and at the end of expansion are 1950 °C and 870 °C. Find the ideal efficiency of the cycle. If the pressure is 1 bar, find the maximum pressure in the cycle. 7

8. *(a)* Draw working fluid flow diagram of the vapour compression refrigeration system and describe the function of each important component of the system. 7

(b) Explain the principles of air-conditioning systems. 7

9. *(a)* Differentiate between annealing and tempering. 7

(b) Discuss briefly tool steels and give its practical application. 7

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