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C09–M–305

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BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2017

DME—THIRD SEMESTER EXAMINATION

THERMAL ENGINEERING—I

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. State the types of thermodynamic properties with one example.

2. Carbon dioxide gas at 27 °C and 1 bar has a density of 1·8 kg/m^3. Determine the gas constant.

3. Represent the following processes on P-V diagram :

(a) Isobaric process

(b) Isentropic process

(c) Isochoric process

4. 0·2 kg of gas at 20 bar undergoes constant pressure process in which the temperature is increased from 500 °C to 950 °C. Calculate the change of entropy. Assume R 0·287 kJ/kg-K and C_p 0·997 kJ/kg-K.

5. Write any six desired characteristics of fuel.

6. A sample of coal has the mass analysis as C 60%, H_2 15%, O_2 15%, N_2 5%, S 3% remaining ash. Calculate the minimum air required for complete combustion of 1 kg of coal.

7. An engine working on Carnot cycle has a maximum and minimum temperature of 727 °C and 27 °C. Determine the efficiency of the engine.

8. Define—

(a) latent heat of vaporization;

(b) internal latent heat of steam.

9. Steam has a quality of 90% dry and 250 kPa. Determine the enthalpy per kg of steam.

10. Define one ton of refrigeration.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. *(a)* State Zeroth law of thermodynamics. 3

(b) A system executes a cyclic process during which there are heat transfers and work done as follows. What is the work done at fourth point?

At point 1, 15 kJ of heat is supplied and 5 kJ of work is done by the system.

At point 2, 4 kJ of heat is rejected and 3 kJ of work is done by the system.

At point 3, 12 kJ of heat is supplied and 8 kJ of work is done by the system.

At point 4, 7 kJ of heat is supplied to the system. 7

12. A quantity of air having a volume of 0·05 m^3 at 1 bar and 27 °C is compressed according to the law $pV^{1\,2}$ C until the pressure becomes 9 bar. Find the change in internal energy and work done during the process. The specific heats are C_V 0 717 kJ/kg-K and C_p 1 005 kJ/kg-K.

13. 2 kg of air is compressed according to law $pV^{1\,3}$ constant and the temperature is raised from 15 °C to 127 °C during the compression. Evaluate the change of entropy. Assume R 0 287 kJ/kg-K and C_p 1 005 kJ/kg-K.

14. Explain the working and construction of Bomb calorimeter to find HCV with a neat sketch.

15. A diesel engine has a compression ratio of 14 : 1. And the heat supply is cut-off at 0·08 stroke, find the air standard efficiency of the cycle. Assume adiabatic ratio as 1·4.

16. One kg of steam having a pressure of 8 bar and dryness fraction 0·95 is expanded to a pressure of 1 bar. If the expansion is adiabatic, determine the final dryness fraction and work done by the steam.

17. Explain the working of air refrigeration working on Bell-Coleman cycle with suitable diagrams.

18. *(a)* An engine working on Otto-cycle has a compression ratio of 6. Find the ideal efficiency of the cycle, if adiabatic index is 1·4.

(b) The value of an adiabatic index of a certain gas is 1·35 and its specific heat at constant volume is 0·72 kJ/kg-K. Determine the gas constant.

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