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C09–M–305

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BOARD DIPLOMA EXAMINATION, (C–09)

APRIL/MAY—2015

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

1. What is the difference between intensive properties and extensive properties?

2. State the terms involved in the equation

$$C_p \quad \frac{R}{1}$$

3. Write the expression for work done in an isothermal process and state the parameters involved.

4. A constant volume chamber of 0 4 m^3 capacity contains 2 kg of a gas at 10 °C. Heat is transferred to the gas until the temperature is 100 °C. Find the initial pressure of gas. Take C_p 1 973 kJ/kg K and C_v 0 1511 kJ/kg K.

5. Write any three advantages and three disadvantages of solid fuels.

6. Why is only HCV obtained with a 'bomb calorimeter'?

7. What do you mean by an air-standard cycle?

8. Show a constant volume process for steam on *p-V T-s* and *h-s* diagrams.

9. Calculate the entropy of dry steam at 20 bar.

10. Write in not more than five lines about dry ice 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 system undergoes a cycle composed of four processes and the energy transfers are tabulated below :

Process	*Q* (kJ/min)	*W* (kJ/min)	*du* (kJ/min)
1–2	550	230	—
2–3	230	—	380
3–4	–500	—	—
4–1	0	70	—

(a) Complete the table and *(b)* determine the rate of work in kW.

12. Derive an expression for work done in an adiabatic process.

13. Certain mass of gas expanding reversibly at constant pressure does 10 kJ of work. Calculate the quantity of heat supplied and change in internal energy. Assume gas is perfect and 1 66.

14. The volumetric analysis of a flue gas is CO_2—15%, CO — 2%, O_2 — 1 5%, N_2 — 81%. The composition of fuel is C—82%, H_2 — 16%, O_2 — 3%. Find—

(a) the mass of carbon in 1 kg of flue gas;

(b) the mass of flue gas per kg of fuel.

15. Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 12, if the fuel cutoff is delayed from 6% to 10%.

16. Determine by using steam tables, the state of steam in the following cases :

(a) P 6 8 bar h 2580 kJ/kg

(b) P 8 bar v 0 17 m^3/kg

(c) P 10 bar v 0 3 m^3/kg

(d) P 12 bar t = 210 °C

17. Explain the process of air refrigeration working on Bell-Coleman cycle with the help of a flow diagram.

18. *(a)* Derive characteristic gas equation from Boyle's law and Charles' law.

(b) An Otto cycle operates with volumes of 0·03 m^3 and 0·5 m^3 at TDC and BDC respectively. If the power output is 150 kW, find the heat input in kJ/sec. Assume 1 4.

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