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C09–M–305

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BOARD DIPLOMA EXAMINATION, (C–09)

MARCH/APRIL—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. Differentiate between open system and closed system.

2. Determine the characteristic gas constant of N_2 gas if 1 kg-mole of N_2 occupies 22·4 m^3 at NTP.

3. Derive an expression for change of entropy in a constant pressure process.

4. 0·06 m^3 of air at 1 bar compresses isothermally to a volume of 0·02 m^3, determine the work done for compression.

5. List out the merits of liquid fuels over solid fuels. Define higher calorific value of fuel.

6. Define higher calorific value of fuel and give Dulong's formula for it.

7. State any six assumptions made in analysis of air standard cycle.

8. What is the condition of steam if its pressure is 7 bar and enthalpy is 2599 kJ/kg?

9. Find the mass of 1 m^3 of steam at 20 bar and 250 °C.

10. Define coefficient of performance of refrigerator.

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. During a complete cycle of operation, a system is subjected to the heat transfers, 452 kJ supplied and 68 kJ rejected. At the two points work is done by the system to the extent of 105 kJ and 185 kJ. At third point there is a further work transfer. Determine its amount, state whether it is done by the system or on the system.

12. 4 kg of gas occupying 1·2 m^3 had an initial temperature of 18 °C. It was then heated at constant volume until its temperature becomes 120 °C. How much heat was transferred to the gas? What was its final pressure? Take R = 0·287 kJ/kgK and C_P = 1·005 kJ/kgK.

13. A quantity of gas is initially at a pressure of 100 kN/m^2, volume of 0·5 m^3 and temperature of 27 °C. It is compressed to a pressure of 1·4 mN/m^2 according to the law $pV^{1.2}$ = constant. Determine *(a)* work transferred, *(b)* heat transferred and *(c)* change in entropy. Take C_V = 0·717 kJ/kgK and C_P = 1·005 kJ/kgK.

14. The composition of a fuel on mass basis is as follows :

$C = 88\%$, $H_2 = 4{\cdot}5\%$, $O_2 = 2\%$, $S = 0{\cdot}5\%$ and ash = 5%

Calculate *(a)* the minimum air required for complete combustion of 1 kg of this fuel and *(b)* the composition of dry flue gases on mass basis if 50% excess air is supplied.

15. Explain the working of Carnot cycle with the help of *P-V* and *T-S* diagrams and also derive the equation for efficiency. Also write the limitations of Carnot cycle.

16. Steam at 20 bar enters boiler carrying 5% moisture. After passing through the superheater, its temperature raised to 400 °C at the same pressure. Determine *(a)* the change in enthalpy and *(b)* the change in specific volume.

17. Explain the process of air refrigeration working of Bell-Coleman cycle with the help of flow diagram and *P-V* diagram.

18. *(a)* An air-standard diesel cycle has compression ratio of 16 and cut-off ratio of 2. Calculate the efficiency of the cycle.

(b) State Boyle's law and Charles's law with formulae.

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