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C16–M–303

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BOARD DIPLOMA EXAMINATION, (C–16)

MARCH/APRIL—2018

DME—THIRD SEMESTER EXAMINATION

BASIC THERMODYNAMICS

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 *three* simple sentences.

1. State the first law of thermodynamics and give mathematical expression.

2. Distinguish between heat and work.

3. Derive the relation between specific heat and gas constant.

4. Represent the following processes on *P-V* diagram :

(a) Adiabatic process

(b) Isothermal process

5. Write a short note on throttling process.

6. Define lower calorific value and higher calorific value.

7. What are the limitations of Carnot cycle?

8. An engine working on Otto cycle has a compression ratio of 6. Find the ideal efficiency of the cycle. Take y 1 4.

9. Compare between two-stroke engine and four-stroke engine. Write any three points.

10. List different types of governing of IC engines.

PART—B

10×5=50

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

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

11. In a steady flow system, a fluid flows at the rate of 4 kg/s. It enters at a velocity of 300 m/s and has enthalpy of 2330 kJ/kg at inlet. It leaves the system at a velocity of 150 m/s and its enthalpy at outlet is 1656 kJ/kg. During its passage through the system, fluid has a loss of heat transfer by 30 kJ/kg to the surroundings. Determine the power of the system in kW. Neglect any changes in the potential energy.

12. *(a)* Carbon dioxide (molecular weight = 44) occupies a tank at 100 °C. If the volume of the tank is 0·5 m^3 and the pressure is 500 kPa, determine the mass of the gas in the tank.

(b) Find higher and lower calorific values of given coal having C = 90%, H_2 5%, S = 1% remaining is ash, by mass.

13. *(a)* Represent the following processes on T-s diagram : 3

(i) Constant pressure

(ii) Constant volume

(iii) Isothermal process

(b) During a constant pressure process, the internal energy of one kg system increases by 28·5 kJ and enthalpy increases by 44·3 kJ. The pressure is 620 kN/m^2 : 7

(i) What is the work which accompanies this process?

(ii) If the initial volume is 0·793 m^3, what is the final volume?

14. A quantity of air has initial pressure, volume and temperature of 3 Mpa, 4 litres and 250 °C respectively. It is expanded to a pressure of 0·4 Mpa accordingly to the law PV^{125} = constant. Determine the change in entropy.

Take C_p 1 005 kJ/kg-K and C_v 0 715 kJ/kg-K

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

16. An air standard Otto cycle with compression ratio 8, compresses air at 1 bar and 303 K. Then maximum cycle temperature is 1273 K. Determine *(a)* heat supplies per kg of air, *(b)* net work done and *(c)* cycle efficiency.

Assume y 1 4, C_v 0 718 kJ/kg-K.

17. Explain the working of two-stroke SI engine.

18. The following observations were made during a trial on two-stroke engine for half an hour when it was running at 250 RPM :

Stroke length = 500 mm

Diameter of bore = 200 mm

Mean effective pressure = 6 bar

Reading of spring balance = 1390 N and 90 N

Mean circumference of brake drum = 3600 mm

Fuel consumed = 5·4 kg

Calorific value of fuel = 44000 kJ/kg

Determine mechanical and thermal efficiencies of the engine.

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