6244

C16–M–303

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BOARD DIPLOMA EXAMINATION, (C–16)

JUNE—2019

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 meant by intensive and extensive properties? Give examples to each.

2. State Boyle's law and Charles's law.

3. Write the corollaries of first law of thermodynamics.

4. 0·05 m^3 of air at 1·2 bar is compressed isothermally to volume of 0·016 m^3. Determine the work energy required for compression.

5. Write the expression for change of entropy for a constant pressure process and name various terms in it.

6. A gas engine working on Otto cycle has a cylinder diameter of 180 mm and stroke of 320 mm. The clearance volume is 0·0022 m^3. Find the air standard efficiency of the engine. Assume $\gamma = 1 \cdot 4$.

7. Why cooling is necessary in IC engines? What is the effect of over cooling?

8. Write any three differences between a petrol engine and a diesel engine.

9. A single cylinder four stroke CI engine has a bore of 100 mm, stroke 120 mm. The indicated mean effective pressure is 500 kN/m^2. Calculate the indicated power at 60 rev/s. If the mechanical efficiency at this speed is 84%, calculate the brake power and power lost in friction.

10. Find the minimum energy required to compress on kg of air from 15 °C and 1 bar to 40 bar in 2-stage compressor. The law of compression is $PV^{1.25} =$ constant and inter cooling is perfect.

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. An oxygen cylinder of 0·45 m^3 capacity contains oxygen at a pressure of 15 bar and temperature of 25 °C. After releasing certain quantity of oxygen the pressure in the cylinder is reduced to 5 bar without change in temperature. Find the mass of oxygen released from the cylinder.

12. A fluid is confined in a cylinder by a spring loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume as per the equation $P = a + bV$. If the fluid changes from initial state of 170 kPa, 0·03 m^3 to final state of 400 kPa, 0·06 m^3 with no work other than that done by the piston. Find the direction and magnitude of the work.

13. 3 kg of air at 1 bar and 300 K compressed polytropically to a pressure of 15 bar and air temperature rises to 500 K. Determine *(a)* the polytropic index, *(b)* the final volume, *(c)* the work of compression and *(d)* the amount of heat rejection from the air. Assume $R = 0 \cdot 287$ kJ / kg K

14. *(a)* State the Clausius and Kelvin-Plank statements of second law of thermodynamics. 4

(b) Write short notes on : 6

(i) Heat pump

(ii) Refrigerator

15. *(a)* Explain diesel cycle with the help of P-V and T-S diagrams.

(b) Mention the reasons for higher efficiency of Carnot cycle over other cycles between same temperature limits. 6+4

16. Explain the working of a simple carburettor with a neat line diagram.

17. Discuss various methods of saving the work required for an air compressor.

18. In a full load test on an oil engine the following results were obtained :

IP = 30 kW, BP = 24 kW, Fuel consumption = 0·128 kg/min

Cylinder circulating water	=	5·9 kg/min
Temperature rise of cooling water	=	49·5 °C
Temperature of exhaust gas	=	387·8 °C
Temperature of engine rook	=	18·4 °C
Air to fuel ratio	=	20
Calorific value of oil	=	45200 kJ/kg
Specific heat of exhaust gas	=	1·05 kJ/kg °C
Specific heat of water	=	4·2 kJ/kg °C

Determine (a) mechanical efficiency, (b) indicated thermal efficiency and (c) draw up energy balance on a basis of kJ/min and in percentage.

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