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C16-M–303

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BOARD DIPLOMA EXAMINATION, (C-16)

MARCH/APRIL—2021

DME - THIRD SEMESTER EXAMINATION

THERMAL ENGINEERING - I

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

PART—A

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.

(4) Assume data wherever necessary.

1. For certain ideal gas, R = 0·278 kJ/kgK and γ = 1·25, determine C_p, C_v values. 3

2. Differentiate intensive and extensive properties with at least one example. 3

3. State the first law of thermodynamics and give mathematical expression. 3

4. Represent the following processes on P-V diagram : 1+1+1

(a) Constant pressure process

(b) Adiabatic process

(c) Isothermal process

5. Write the expression for work done in Isothermal process and state the parameters involved. 3

6. What are the assumptions made in analysis of air standard cycle? 3

7. List various methods of lubricating system in IC Engines. 3

8. Differentiate coil ignition system with magneto ignition system. 3

9. Define the following terms : 1½+1½

(a) Brake power

(b) Mechanical efficiency

10. Write any three differences between Centrifugal compressor and Axial flow compressors. 3

PART—B

10×5=50

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

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

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

(4) Assume data wherever necessary for air R = 0·287 kJ/kg K, γ = 1·4, if not specified.

11. 0·2 kg of gas is subjected to change of temperature from 15 °C to 180 °C at constant pressure. Find the heat transfer, change of internal energy and change of Enthalpy. If specific heat at constant pressure is 1·0 kJ/kg.K, Adiabatic index is 1·4. 10

12. Explain the following terms with neat sketches.

(a) Quasi-Static work

(b) Flow work 5+5

13. In a steady flow system, the working fluid flowing at 5 kg/sec enters the system with a velocity of 300 m/sec and it has a specific enthalpy of 390 kJ/kg. The velocity, enthalpy at exit are 150 m/s and 289 kJ/kg respectively. The fluid loses 5 kJ/kg heat as it passes through the system. Determine the power of system stating whether it is from or to the system. 10

14. A quantity of gas has an initial pressure, volume and temperature of 150 kN/m^2, 0·14 m^3 and 25 °C respectively. It is compressed to a pressure of 1·5 MN/m^2 according to the law $PV^{1.25}$ = constant.

Determine : *(a)* work transfer to the gas 4+3+3

(b) Heat transfer from the gas

(c) The change of entropy

Take C_p = 1·041 kJ/kg K, C_v = 0·714 kJ/kg K.

15. In an engine working, a Diesel cycle has a compression ratio 15 :1 and expansion ratio 8 : 1. The pressure and temperature at beginning of compression are 1 bar and 40 °C respectively. Pressure before the heat rejection is 2·4 bar. Determine :

(a) Air standard efficiency of the cycle 3+7

(b) Maximum temperature and pressure attained in the cycle

Assume ratio of specific heat, γ =1·4.

16. Explain the working of magneto – ignition system with the help of a line diagram. 10

17. A four stroke petrol engine with a compressor ratio of 6·5 to 1 and total displacement of 5·2 × 10^{-3} m^3 develops 120 kW BP and consumes 33 kg of petrol per hour of calorific value 44300 kJ/kg at 3000 rpm.

Find 1. Brake mean effective pressure

2. Brake thermal efficiency

3. Air standard efficiency

Take γ =1·4. 4+3+3

18. A two stage compressor is used to compress 1 kg of free air from 1 bar and 32° C to 26 bar. The value of n = 1·3 and R = 0·287 kJ/kg K.

Find the following :

(a) The intermediate pressure

(b) Work required for best performance

(c) Work for a corresponding single – stage compressor

(d) Percentage saving in works in two stage compressor 10

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