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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, $R = 0.278 \text{ kJ/kgK}$ and $\gamma = 1.25$, 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

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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 $R = 0.287 \text{ kJ/kg K}$, $\gamma = 1.4$, if not specified.

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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

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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/m², 0.14 m³ and 25 °C respectively. It is compressed to a pressure of 1.5 MN/m² according to the law $PV^{1.25} = \text{constant}$.

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, $\gamma = 1.4$.

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} m³ 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 $\gamma = 1.4$. 4+3+3

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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

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