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C16-M–303

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BOARD DIPLOMA EXAMINATION, (C-16)

AUGUST/SEPTEMBER—2021

DME - THIRD SEMESTER EXAMINATION

THERMAL ENGINEERING - 1

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. State the relationship between two specific heats of a gas with its characteristic gas constant and mention the relevant units.

2. Define the terms *(a)* state and *(b)* cycle of a thermodynamic system.

3. Write three differences between non-flow and steady-flow processes.

4. Represent the following processes on T-s diagram :

(a) Isentropic process

(b) Isothermal process

5. Write the expression for change in entropy for isochoric process and name the terms involved in it.

6. Define air standard efficiency. Write mathematical expression for it.

7. Write the classification of IC engines.

8. State three differences between 2-stroke and 4-stroke IC engines.

9. List the available equipment for pollution check on an IC engine.

10. Write three reasons for the use of multistage compressors.

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.

11. A vessel of 2·5 m^3 capacity contains one kg-mole of nitrogen at 100 °C. If the gas is cooled to 30 °C, calculate *(a)* final pressure, *(b)* change in specific internal energy and *(c)* change in specific enthalpy. Take γ = 1·4 and one kg-mole nitrogen is 28 kg.

12. The pressure in the cylinder varies with the relation $p = \left[\frac{C}{V}\right]$ kPa, where C is a constant. Determine the work done if the initial pressure is 400 kPa and volume changes from 0·02 m^3 to 0·08 m^3.

13. A system undergoes a cycle, which comprises four processes as shown in the table :

Process	Q (kJ/min)	W (kJ/min)	dU (kJ/min)
1–2	550	230	-
2–3	230	-	380
3–4	–250	-	-
4–1	0	80	-

(a) Complete the table, *(b)* determine the rate of work in kW and *(c)* show $\oint dU = 0$.

14. A mass of air at 1·3 MN/m^2 pressure, 0·014 m^3 volume and 135 °C is expanded until its final pressure is 275 kN/m^2 and volume becomes 0·056 m^3. Calculate *(a)* mass of air, *(b)* the final temperature, *(c)* law of expansion, *(d)* work transfer and *(e)* heat transfer. Assume C_p = 1·005 kJ/kg-K, C_v = 0·718 kJ/kg-K and γ = 1·4.

15. Explain various processes of diesel cycle with the help of p-V and T-s diagrams and mention various assumptions made in the analysis of diesel cycle.

16. Explain the construction and working of Zenith carburetor with a neat sketch.

17. The following details refers to a four stroke single cylinder petrol engine :

Cylinder diameter = 300 mm

Length of stroke = 400 mm

Speed = 900 r.p.m

Effective brake load = 480 N

Effective diameter of the brake drum = 0·7 m

IMEP = 0·28 N/mm^2

Calculate *(a)* indicated power, *(b)* brake power, *(c)* friction power and *(d)* mechanical efficiency.

18. A single stage single acting air compressor has a cylinder diameter of 30 cm and a stroke of 40 cm. Air is taken at 1 bar and 20 °C into the cylinder and compresses it to a pressure of 5 bar at 100 r.p.m. Find the work done and power required if the compression is *(a)* isothermal and *(b)* $pV^{1·2} = C$ and *(c)* adiabatic. Take R = 0·287 kJ/kg-K, $\gamma = 1·4$.

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