TED (15/19) – 4024
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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, NOVEMBER – 2023

THERMAL ENGINEERING

[Note:- Use of steam tables and Mollier chart is Permitted]

[Maximum Marks : 100] [Time : 3 hours]

PART – A

(Maximum Marks : 10)

Marks

I. Answer **all** questions in one or two sentences. Each question carries 2 marks.

1. Define Quasistatic process.
2. Distinguish between isochoric and isobaric process.
3. Define compression ratio.
4. What is the function of steam nozzle?
5. List three modes of heat transfer. (5x2=10)

PART – B

(Maximum Marks : 30)

II. Answer any **five** of the following questions. Each question carries 6 marks.

1. Explain Zeroth law, First law and Second law of thermodynamics.
2. State the assumptions made in air standard cycles.
3. Illustrate air standard efficiency of Otto cycle with a P-V & T-S diagrams.
4. Define Total fuel consumption and Specific fuel consumption.
5. Distinguish between Wet steam, Dry steam and Super-heated steam.
6. Define absorptivity, reflectivity and transmissivity.
7. List the advantages of multistage compression. (5x6=30)

PART – C

(Maximum Marks : 60)

(Answer **one full** question from each unit. Each full question carries 15 marks)

UNIT – I

III. (a) Derive characteristic gas equation. (7)

(b) A gas occupies a volume of 0.1 m^3 at a temperature of 27°C and at a pressure of 1.5 bar. Find the final temperature of the gas, it is compressed to a pressure of 7 bar occupies a volume of 0.03 m^3. (8)

OR

IV. (a) Derive the relationship between specific heat at constant volume to that of specific heat at constant pressure for a gas undergoing a process. (7)

(b) A gas whose pressure, volume and temperature are 275 kN/m^2, 0.09m^3 and 185°C respectively has its state changed at constant pressure until its temperature becomes 15°C . Calculate the heat transfers and work transfers during the process. Take C_p=1.005kJ/kg.K ; R= 0.29KJ/Kg.K. (8)

UNIT – II

V. (a) Derive an expression for air standard efficiency of Otto cycle in terms of Compression ratio. (7)

(b) A gas engine has a cylinder of 100 mm in diameter and stroke 150 mm with a clearance volume of 250000 mm^3. Find the air standard efficiency of the engine working in the Otto cycle (Take $\gamma = 1.4$ for gas) (8)

OR

VI. (a) Derive an expression for air standard efficiency of Carnot cycle. (7)

(b) The temperature limits for a carnot cycle using air as working fluid are 420°C and 10°C. Calculate the efficiency of the cycle and ratio of adiabatic expansion. (Assume $\gamma = 1.4$) (8)

UNIT –III

VII. (a) Explain the Morse test. (7)

(b) A four cylinder, 4 stroke petrol engine runs at 1200 rpm. Bore diameter of cylinder is 0.09 m and stroke is 0.120 m. The mean effective pressure in each cylinder is 500 kPa. Mechanical efficiency being 75%. Calculate indicated power and brake power of the engine. (8)

OR

VIII. (a) Explain the working of double acting steam engine with simple line sketch. (7)

(b) Determine from steam tables the following :

(i) Enthalpy and volume of 1 kg of steam at 12.1 bar and dryness fraction 0.9 and

(ii) Enthalpy and volume of 1 kg of steam at 12.1 bar and 225'C.

Take the specific heat at constant pressure for superheated steam as 2.1 kJ/kg K (8)

UNIT – IV

IX. (a) Define the following:-

(i) Thermal Conductivity (ii) Free convection (iii) Forced convection. (7)

(b) A brick wall 300 mm thick is faced with concrete 20 mm thick. If the temperature of the exposed brick face is 30°C and that of the concrete is 5°C, determine the heat loss per hour through a wall 10 m long and 3 m high. Determine also the interface temperature, given thermal conductivities of the brick and concrete are 0.69W/m°C and 0.93 W/m°C respectively. (8)

OR

X. (a) Explain Volumetric efficiency of a reciprocating compressor and list the factors affecting volumetric efficiency. (7)

(b) A single acting single stage air compressor is required to compress 1 kg of air from 100kPa to 400kPa. The initial temperature is 27°C. Calculate the power required to drive the compressor in the following cases, if the speed is 100 rpm. Assume characteristic gas constant as 0.287 kJ/kg K. Take $\gamma = 1.4$.

(1) Isothermal compression

(2) Isentropic compression. (8)

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