TED (15/19) – 4024
(Revision – 2015/19)

N22 - 01408

Reg.No……..
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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE – NOVEMBER – 2022

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 Thermodynamic system.
2. State Zeroth law of Thermodynamics.
3. Define Air standard cycle.
4. What is the function of steam nozzle.
5. State Fourier's law of Thermal conduction. (5x2=10)

PART –B
(Maximum Marks : 30)

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

1. Derive expression for expansion work during Isothermal process.
2. State the assumptions made in air standard cycles.
3. Illustrate Carnot cycle with P-V & T-S diagrams.
4. Define Indicated power, Brake power and Mechanical efficiency of IC engine.
5. Distinguish between Wet steam, Dry steam and Super heated steam.
6. Explain Recuperator type and regenerative type heat exchangers with 2 examples for each.
7. Explain with simple sketch, the working of centrifugal compressor. (5x6=30)

PART – C
(Maximum Marks : 60)
(Answer **one full** question from each unit. Each full question carries 15 marks)

UNIT – I

III. (a) Explain Thermodynamic equilibrium. (7)

(b) Certain gas occupies a space of $0.3m^3$ at pressure of 2 bar and at a temperature of 77°C. It is heated at constant volume until the pressure is 7 bar. Determine (i) temperature at the end of process (ii) mass of gas (iii) change in internal energy and (iv) change in enthalpy during the process.

Take CP=1.005 KJ/KgK, CV = 0.712 KJ/KgK. (8)

OR

IV. (a) Derive an expression for expansion work during adiabatic process. (7)

(b) Certain amount of air has volume of 0.192 m^3 at a pressure of 1 bar and temperature 43°C. It is compressed polytropically to a volume of 0.0142 m^3. Find (i) Pressure at the end of compression. (ii) Mass of gas (iii) Work done during compression and (iv) heat rejected during compression.

Take γ =1.4, R= 0.289KJ/KgK, n = 1.37. (8)

UNIT – II

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

(b) A compression ignition engine working on diesel cycle has cylinder bore 150mm, stroke 250mm and clearance volume 4×10^5 mm^3. If cut-off takes place at 5% of stroke, find (i) Compression ratio (ii) cut-off ratio and (iii) air standard efficiency of the engine. Take γ = 1.4. (8)

OR

VI. (a) In an Otto cycle, the temperature at the beginning and end of the isentropic compression are 43°C and 323°C respectively. Determine the compression ratio and air standard efficiency. Take γ = 1.4. (7)

(b) Derive an expression for air standard efficiency of Joule's cycle in terms of compression ratio. (8)

UNIT –III

VII. (a) Explain heat balance sheet. (7)

(b) In a test on a single cylinder oil engine working on four stroke cycle and fitted with simple rope brake, the following reading were taken. Effective diameter of brake wheel = 0.625m. Net load on the brake wheel = 170N, Speed of engine = 450rpm
Indicated mean effective pressure = 770KPa.
Diameter of cylinder = 100 mm, Stroke = 150mm
Fuel consumption = 0.83 Kg/hr, Calorific value of fuel = 42000 KJ/Kg.
Calculate (i) Brake power (ii) Indicated power (iii) Mechanical efficiency and (iv) Indicated thermal efficiency. (8)

OR

VIII. (a) Dry saturated steam at a pressure of 10 bar is expanded isentropically in a nozzle to a pressure of 0.7 bar. Represent the process in mollier diagram and find the velocity and dryness fraction of steam issuing from the nozzle with the help of mollier diagram, neglecting friction. (7)

(b) Determine the quantity of heat required to produce 1 Kg of steam at a pressure of 6 bar from water at 25°C under the following conditions.
(i) When steam is wet having dryness fraction 0.9
(ii) When steam is super heated at constant pressure at 250°C.
Assume mean specific heat of super heated steam as 2.3KJ/KgK. (8)

UNIT – IV

IX. (a) Define the following :-
(i) Thermal Conductivity (ii) Convection (iii) Free convection (iv) Forced convection. (7)

(b) A composite wall composed of fire clay brick of 0.2m thick (K= 1.039 w/m-k), Insulation of 0.1m thick (K= 0.278 w/m-k) and Common brick of 0.1m thick (K= 0.694 w/m-k) in sequence. The innerface temperature of fire clay brick is 870°C and outer surface temperature of common brick is 38°C. Determine the rate of heat flow per unit area through the wall and interface temperature between common brick an insulation. (8)

OR

X. (a) Explain with simple sketch, the working of axial flow compressor. (7)

(b) A single stage compressor is required to compress 1.2 m^3 of air per minute from 1 bar and 15°C to 8 bar. Determine power required to drive the compressor when the compression is (i) Adiabatic and (ii) Isothermal. Take $\gamma = 1.4$. (8)

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