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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, APRIL - 2025

THERMAL ENGINEERING

[Maximum marks: 100] [Time: 3 Hours]

PART – A
Maximum marks: 10

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

1. Define state of system.
2. Distinguish between intrinsic and extrinsic properties.
3. Define air standard efficiency.
4. State specific fuel consumption.
5. Define heat exchanger. (5 x 2 = 10)

PART – B
Maximum marks: 30

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

1. Derive the expression for external work done during isothermal process.
2. Illustrate Carnot cycle with P-V and T-S diagram.
3. Compare SI and CI engine.
4. Define (i) Mechanical efficiency (ii) Relative efficiency (iii) Thermal efficiency
5. Derive an expression for velocity of steam leaving through a nozzle.
6. Explain Fourier's law of thermal conduction.
7. Explain Newton Rikhman equation of Thermal convection. (5 x 6 = 30)

PART – C
Maximum marks: 60

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

UNIT – I

III. (a) Derive the expressions for work done, change in internal energy, heat transferred and change in enthalpy for an isobaric process. (7)

(b) A closed vessel contains 2 kg of CO_2 at a temperature 20^0 C and pressure 0.7 bar. Heat is supplied to the vessel till the pressure becomes 1.4 bar. Find (i) Final temperature (ii) work done (iii) heat added (Cv = 0.657 kJ/kgK) (8)

OR

IV. (a) Define Boyle's law, Charle's law and derive general gas equation. (7)

(b) 5 m^3 of air at 0^0 C and a pressure of 3 bar is heated to 80^0 C at constant pressure. Find (i) Change in internal energy (ii) Work done (iii) Heat transfer. (8)

UNIT - II

V. (a) Explain Diesel Cycle with P-V and T-S diagram. (7)

(b) In an Otto cycle, the temperature at the beginning and end of the isentropic compression are 53^0C and 343^0C respectively. Determine the compression ratio and air standard efficiency. Take γ = 1.4. (8)

OR

VI. (a) Explain the working of a 4-stroke petrol engine with schematic diagram. (7)

(b) An ideal diesel engine has a bore diameter 150 mm and stroke 200 mm. The clearance volume is 10% of the swept volume. Determine the compression ratio and air standard efficiency of the engine. if the cut off take place at 6% of the stroke. (8)

UNIT - III

VII. (a) Explain heat balance sheet with various parameters required. (7)

(b) A four stroke four-cylinder engine running at 2400 rpm gives 40 kW brake power. The average torque when one cylinder was cut out was 0.118kNm. Determine the indicated thermal efficiency if the calorific value of fuel is 43000 kJ/kg and the engine uses 0.38 kg of petrol per brake power hours. (8)

OR

VIII. (a) Explain the process of formation of steam at constant pressure with graph. (7)

(b) Determine the amount of heat, which should be supplied to 3kg of water at 30^0C to convert it into steam at 6 bar and 0.95 dry. (8)

UNIT – IV

IX. (a) Explain parallel flow, counter flow and cross flow type heat exchangers. (7)

(b) Heat is conducted through a composite plate composed of two parallel plates of different materials A and B of thermal conductivities 134 W/mK and 60 W/mK and thickness 36 mm and 42 mm respectively. The temperature of outer surface of slab A and B are 96^0C and 8^0C respectively. Find the rate of heat transfer and interface temperature if the cross-sectional area of plate across the direction of heat flow is 10 m^2 (8)

OR

X. (a) Explain the Classification of air compressors. (7)

(b) Explain the working of an axial flow compressor with sketch. (8)
