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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, NOVEMBER - 2024

THERMAL ENGINEERING

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

(Standard Steam tables are permitted)

PART – A
Maximum marks: 10

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

1. Define Thermodynamics.
2. State Charle's law.
3. Define Compression ratio.
4. Define Mechanical efficiency of an engine.
5. Define Thermal conductivity. **(5 x 2 = 10)**

PART – B
Maximum marks: 30

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

1. Explain Second law of thermodynamics with Heat Engine and Heat pump.
2. Explain ideal Otto cycle with PV and TS Diagrams.
3. Draw the Valve timing diagram for a 4-stroke diesel engine. Mention its significant points.
4. Explain Heat balance sheet.
5. List the uses of steam.
6. Explain the concept of overall heat transfer co-efficient and LMTD.
7. List the advantages of multi stage compression. **(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 Characteristic gas equation. Mention the relation between Characteristic and universal gas constants. (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, if it is compressed to a pressure of 7 bar occupies a volume of 0.03 m^3. Calculate the mass of gas if R = 287 J/Kg K. (8)

OR

IV. (a) Derive the expression for work done during an isothermal process. (7)

(b) 0.45kg of air expands isothermally through a volume ratio 6:1. The initial pressure and temperature are 2.75 MPa and 260°C respectively. Find the initial volume of air, final pressure of air, and work done during isothermal expansion. Take C_p = 1005J/KgK and Cv = 712 J/KgK. (8)

UNIT – II

V. (a) State the assumptions made in Air standard cycles. Define air standard efficiency. (7)

(b) In an engine working on Otto cycle the measured suction temperature was 100°C and the temperature at the end of compression was 300°C. Taking adiabatic index for compression as 1.41. Find the ideal efficiency and compression ratio. (8)

OR

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

(b) Explain the working of a 4 stroke petrol engine with Diagram. (8)

UNIT - III

VII. (a) Explain Morse test for a multi cylinder engine. (7)

(b) A two cylinder 4-stroke cycle I.C engine is to be designed to develop 15kW IP at 1200 rpm. The mean effective pressure of the cycle is limited to 600kPa. Determine the bore diameter, and stroke of the engine if stroke = 1.2 x bore diameter. (8)

OR

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

(b) Determine the amount of heat, which should be supplied to 2kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry. (8)

UNIT – IV

IX. (a) Explain the classification of Heat exchangers with figure. (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) Define absorptivity, reflectivity, and transmissivity. Mention their relation. (7)

(b) Find the power required to drive an air compressor which has to compress 40 m^3 of air per minute from 105 kN/m^2 to 410 kN/m^2. Assume that the index *n* for the compression curve is 1.3. (8)
