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(REVISION — 2015)

Reg. No. .....

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

THERMAL ENGINEERING

[*Time* : 3 hours

(Maximum marks : 100)

[*Note* :— Use of steam tables & Mollier chart is permitted.]

PART — A

(Maximum marks : 10)

Marks

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

1. Define specific heat of gas at constant pressure and specific heat at constant volume.
2. List two types of brake dynamometer used for measuring brake power.
3. Define dryness fraction of steam.
4. State Stefan-Boltzman law.
5. Define volumetric efficiency of a reciprocating air compressor. (5 × 2 = 10)

PART — B

(Maximum marks : 30)

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

1. Derive the characteristic gas equation.
2. Explain Otto cycle with P-V diagram.
3. Explain the concept of Black body.
4. Define : (a) Indicated power (b) Brake power.
5. Explain formation of steam with the help of temperature-enthalpy curve.
6. Draw and explain temperature profiles of parallel flow and counter flow heat exchangers.
7. State six uses of compressed air. (5 × 6 = 30)

Marks

PART — C

(Maximum marks : 60)

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

UNIT — I

III (a) Explain Quasistatic process with the help of P-V diagram. 7

(b) A gas having initial pressure, volume, temperature as 275kN/m^2, 0.09m^3, and 185°C respectively, is compressed at constant pressure until its temperature is 15°C. Calculate the amount of heat transferred and work done during the process. Take R = 290 J/kgK and Cp = 1.005kJ/kgK. 8

OR

IV (a) Illustrate Isothermal process with the help of P-V diagram. 7

(b) A quantity of gas has a pressure of 350kPa when its volume is 0.03 m^3 and temperature is 35°C. If R = 0.29kJ/kgK for this gas, determine the mass of the gas present. If the pressure is increased to 1MPa while volume remains constant, find out new temperature. 8

UNIT — II

V (a) Derive the expression for air standard efficiency of Carnot cycle. 7

(b) An ideal diesel engine has a bore diagram 150mm and stroke 200mm. 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

OR

VI (a) Illustrate Otto cycle with the help of P V and T S diagram. 7

(b) 0.23kg of gas is taken through a Carnot cycle whose temperature limits are 300°C and 50°C. If the Volume ratio of expansion of the isothermals is 2.5, determine (i) air standard efficiency of cycle and (ii) work done per cycle. Take R = 0.28kJ/kgK. 8

UNIT — III

VII (a) Explain the procedure for conducting Morse test for finding the IP of multi cylinder engines. 7

(b) A two cylinder 4-stroke cycle I C engine is to be designed to develop 15kW IP at 1200 RPM. The m.e.p of the cycle is limited to 6 bar. Determine the bore diameter and stroke of the engine if stroke = 1.2 × bore diameter. 8

OR

VIII (a) Define specific enthalpy of wet steam and specific enthalpy of dry saturated steam. 7

(b) Calculate the total heat of 5kg of steam at an absolute pressure of 8 bar having dryness fraction of 0.8. Also calculate heat required in kJ to convert the steam in to dry and saturated steam. 8

Marks

UNIT — IV

IX (a) Define the term thermal convection and state Newton - Rikhman equation of thermal convection. 7

(b) The inside and outside surfaces of a window glass are at 20°C and −5°C respectively. If the glass is 1000mm × 500mm in size and 15 mm thick with thermal conductivity of 0.78W/mK. Determine the heat loss through the glass over a period of 2 hours. 8

OR

X (a) Explain the construction and working of single stage reciprocating air compressor with the help of Schematic diagram. 7

(b) Find the amount of work required to compress and discharge $1m^3$ of air at 15°C and 1 bar to 7 bars absolute. When compression is isothermal. Take R = 0.29kJ/kgK. 8