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CBCS SCHEME

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17AU33

Third Semester B.E. Degree Examination, July/August 2022
Engineering Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Thermodynamic data handbook , Steam tables are permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. With suitable sketches / examples distinguish between : i) Closed and Open system ii) Path and Point function iii) Thermal and Mechanical equilibrium. **(06 Marks)**

b. State Zeroth law of thermodynamics and extract the concept of temperature from it. **(04 Marks)**

c. The temperature 't' on a certain celsuis thermometric scale is given by means of a property through a relations $t = a\ell np + b$, where a and b are constants and P is the property of the fluid. If, at the ice point and steam points the values of P are found to be 4 and 20 respectively, what will be temperature reading corresponding to a reading of P = 16? **(10 Marks)**

OR

2 a. Distinguish between Heat and Work. **(04 Marks)**

b. A system undergoes a process in which the pressure and volume are related by the equation of the form $PV^n = C$. Derive an expression for displacement work during this process. **(08 Marks)**

c. A spherical Balloon of 1m diameter contains a gas at 250 KPa and 300K. The gas inside is heated until the pressure reaches to 500 KPA. During this process of heating , the pressure of gas inside the Balloon is proportional to the diameter of the Balloon. Calculate the work done by the gas inside the Balloon **(08 Marks)**

Module-2

3 a. State First Law of Thermodynamics and explain Joule's experiment, with neat sketch. **(06 Marks)**

b. Prove that Internal energy is a property of the system. **(06 Marks)**

c. Write the steady flow energy equation for an open system. Explain the terms involved in it. Simply SFEE for following system i) Steam turbine ii) Nozzle. **(08 Marks)**

OR

4 a. State Kelvin Plank and Clausius statement of second law of thermodynamics and show that they are equivalent. **(06 Marks)**

b. State and prove Clausius Inequality. **(08 Marks)**

c. A heat engine working on Carnot cycle converts one – fifth of the heat input into work. When the temperature of the sink is reduced by 80°C the efficiency gets doubled. Calculate for the temperature of source and sink. **(06 Marks)**

Module-3

5 a. With the help of P – V and T – S diagram, derive an expression for Air – standard efficiency of Otto Cycle with usual notation. **(10 Marks)**

b. With the help of P – V and T – S diagram. Derive an expression for the efficiency of diesel cycle in terms of its compression and cut – off ratios. **(10 Marks)**

OR

6 a. Describe the Morse test. How it can be used to find the friction power and indicated power of an IC engine. **(08 Marks)**

b. A 4 stroke, 4 – cylinder petrol engine of cylinder dimensions 10cm × 12cm has a compression ratio of 7. It is tested at 3000 rpm with a dynamometer which has 50cm arm. During 10 – minute test, the dynamometer scales reads 40kg of fuel and engine consumes 4.8 kg of fuel. Air is supplied at 1 bar and 300K is 6kg/min assuming CV of fuel as 44MJ/kg. **(12 Marks)**

Module-4

7 a. Explain Vapor absorption refrigeration system with neat sketch. **(08 Marks)**

b. Write short note on :
i) Steam Jet refrigeration ii) Refrigerants and their properties. **(12 Marks)**

OR

8 a. Define and Explain : i) Dry bulb temperature ii) Wet bulb temperature
iii) Dew point temperature iv) Specific Humidity v) Relative Humidity. **(10 Marks)**

b. Describe Summer Air conditioning system for hot and humid outdoor conditions. **(10 Marks)**

Module-5

9 a. Derive the expression for the isothermal work done by a reciprocating compression of single stage, neglecting clearance volume. **(10 Marks)**

b. Derive the condition for minimum work input to a two stage reciprocating Air compressor with perfect inter cooling. **(10 Marks)**

OR

10 a. Classify and explain Constant Pressure gas turbines with neat sketch. **(08 Marks)**

b. Explain the following with neat diagram :
i) Turbo Jet Engine ii) Turbo Prop Engine iii) Rocket Propulsion. **(12 Marks)**

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