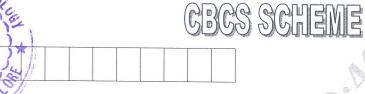
TEUMN



15AU33

Third Semester B.E. Degree Examination, July/August 2021 **Engineering Thermodynamics**

Time: 3 hrs. Note: Answer any FIVE full questions.

Max. Marks:80

- a. Define the following terms, with respect to thermodynamic: i) Open system ii) Closed system iii) Isolated system iv) Quasi static process. (08 Marks) b. State and explain zeroth law of thermodynamics. (04 Marks)
 - c. A temperature 'T' on a thermometric scale is defined interms of property 'P' by relation $T = a \log_e P + b$ where 'a' and 'b' are constants. The temperature at ice point and steam point are 0°C and 100°C respectively. Instrument gives values of P as 1.86 and 6.81 at ice point and steam point respectively. Evaluate temperature corresponding to reading of P=2.5.

(04 Marks)

- Derive an expression for work done during quasi static process and explain its significance with the help of P-V diagram. (04 Marks)
 - b. Write thermodynamic definitions of work and heat. Also writ similarities between them.

(04 Marks)

- c. A gas has as initial volume of 0.4m³ and expands to a final volume of 0.2m³. The initial pressure at the gas is 0.1MPa. Find the work done if the gas is held at a constant temperature of 300K and the pressure between the initial and final states of the system,
 - i) constant ii) inversely proportional to volume.

(08 Marks)

- Represent schematically heat engine, heat pump and refrigerator. Give their performance.
 - b. A nozzle is a device for increasing the velocity of a steadily flowing steam. At the inlet to a certain nozzle. The enthalpy of the fluid passing is 3000kJ/kg and velocity is 60m/s. At the discharge and the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there negligible heat loss from it.
 - Find the velocity at the exit section of the nozzle
 - ii) If the inlet area is 0.1m^2 and specific volume at inlet is $0.187 \text{m}^3/\text{kg}$, find the mass flow
 - iii) If the specific volume at the nozzle exit is 0.498 m³/kg, find diameter at the exit section of the nozzle. (08 Marks)
- Prove that entropy is a property of a system.

(06 Marks)

b. Write Kelvin plank and Clausius statement.

(04 Marks)

- A heat engine working on Carnot cycle converts $\frac{1}{5}$ th of the heat i/p 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)
- 5 Define the followings:
 - i) Stoichiometric air ii) Enthalpy of combustion iii) Air Fuel ratio (A/F). (04 Marks)
 - b. With neat sketch explain the analysis of fuel gasses by Orsat apparatus. (08 Marks)
 - c. An air standard diesel cycle has a compression ratio of 18 and the heat transferred to the working fluid per cycle is 2000kJ/kg. At the beginning of the compression stroke. The pressure is 1 bar and the temperature is 300K calculate the thermal efficiency. (04 Marks)

- a. Define the following terms with respect to IC engine and write the formula:
 i) Brake power
 ii) Indicated power
 iii) Friction power
 iv) Specific fuel consumption
 - v) Mechanical efficiency vi) Heat balance sheet. (08 Marks)
 - Explain the Morse test method of determining the indicated power and hence the frictional power of IC engine.
 A single cylinder four stroke gasoline engine is to operate at 400rpm and deliver 75KW.
 - Determine : i) the bore and stroke ii) indicated power and BMEP = 8.4bar, $\eta_{mech} = 80\%$ (04 Marks)
- a. Explain steam jet refrigeration system with a neat sketch, write its draw back.

 b. Write desirable properties of a good refrigerant.

 (08 Marks)

 (04 Marks)
 - c. 2KW per ton of refrigeration is required to maintain the temperature of (-40°C) in the refrigerator. IF the refrigerator works on Carnot cycle determine:
 - COP of the cycle
 Temperature of the sink
 Heat rejected in the sink per ton of refrigeration
 Heat supplied.

(04 Marks)

- a. With a neat sketch, describe the winter air conditioning system. (08 Marks)
 b. Air at 30°C DBT and 25°C WBT is heated to 40°C. If the air is 300m³/min. Find the amount of heat added/min and RH and WBT of air. Take air pressure to be 1bar. (08 Marks)
- 9 a. Derive the expression for work done in a single stage compressor neglecting clearance volume. For the polytrophic and isothermal compression. (08 Marks)
 - b. A single stage acting air compressor 30cm bore and 40cm stroke is running at a speed of 100RPM. It takes in air at 1bar and 20°C and compresses it to a pressure of 5 bar. Find the power required to drive it when the compression i) Isothermal ii) PV^{1.2} = c and neglecting clearance and draw PV diagram. (08 Marks)
- 10 a. Explain turbo jet with the help of a neat sketch. Write its advantages and disadvantages.

(08 Marks)

b. Explain open and closed cycle gas turbines with a neat sketch.

(04 Marks)

c. In a simple gas turbine plant air is compressed from 1bar and 25°C through a pressure ration of 4:1. It is then heated by 150°C in a combustion chamber and expanded back to atmospheric pressure of 1bar in the turbine calculate the cycle efficiency and turbine outlet temperature.

(04 Marks)

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