BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)
B. Tech. Sem - III MECHANICAL : WINTER- 2022
SUBJECT : THERMODYNAMICS PRINCIPLES

Day : Wednesday | Time : 10:00 AM-01:00 PM

Date : 07-12-2022 | **W-25345-2022** | Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Use of non-programmable calculator is **allowed.**
4) Assume suitable data **WHEREVER** necessary.
5) Use of **Steam Table** is allowed

Q.1 Explain First Law of Thermodynamics. Discuss different applications for First Law of Thermodynamics to flow and non-flow processes. **(10)**

OR

Q.1 A nozzle is a device for increasing the velocity of stream. At the inlet to the nozzle the enthalpy of the fluid passing is 3000 kJ/Kg and the velocity of 60 m/sec. At the discharge end the enthalpy is 2757 kJ/kg. The nozzle is horizontal and heat loss is negligible ; **(10)**

i) Find the velocity at exit from nozzle.
ii) If the inlet area is 0.1 m^2 and specific volume at inlet is 0.187 m^3/kg. Find mass flow rate.
iii) If the specific volume at outlet is 0.498 m^3/kg. Find the area at exit of nozzle.

Q.2 Explain principle of increase of Entropy. A domestic food freezer is to be maintained at temperature of -15^0C.The ambient air temperature is 30^0C. If the heat leaks into the freezer at the rate of 1.75 kJ/sec. Find the required power to run the freezer. **(10)**

OR

Q.2 Explain heat pump and refrigerator with block diagram. A revised cycle has refrigerating COP of 4 ; **(10)**

i) Determine the ratio $\frac{T_1}{T_2}$.

ii) If the work done on the cycle is 10 kW, determine the maximum refrigerating effect in TR.

Q.3 Explain the process of steam generation at constant pressure. **(10)**
Steam at a pressure of 5.4 bar and dryness fraction of 0.8 expands in a cylinder reversibly and isothermally to a pressure of 1 bar. Find –

i) Final condition of steam
ii) Change in internal energy
iii) Change in entropy
iv) Heat transferred
v) Work done per kg of steam.

Show process on P-V and T-S diagram.

OR

Q.3 Explain separating calorimeter with sketch. Steam at a pressure of 4 bar and dryness 0.7 is allowed to expand at a constant volume, until the pressure rises to 5.5 bar, find the final condition of steam and the heat absorbed by 1 kg of steam. **(10)**

Q.4 Derive the efficiency of Carnot Cycle. Discuss the performance parameters of Vapour Power Cycle. **(10)**

OR

PTO

Q.4 Discuss effect of Boiler Pressure on performance of Rankine Cycle. A steam turbine receives steam at 15 bar and 350^0C and exhausts to the condenser at 0.06 bar. Determine the thermal efficiency of ideal Rankine Cycle operating between these two limits. **(10)**

Q.5 Differentiate between Diesel and Dual cycle on the basis of same compression ratio and same amount of Heat Supplied. Derive expression for dual cycle for thermal efficiency. **(10)**

OR

Q.5 Discuss Brayton cycle with P-V and T-S diagram. Also determine expression for thermal efficiency of Diesel cycle. **(10)**

Q.6 Explain Orsat apparatus with block diagram. Give the classification of fuels. **(10)**

OR

Q.6 A fuel oil has following analysis by mass : C = 85%, H_2 = 12.5 %, O_2 = 2% and the residue = 0.5 % . **(10)**
The dry flue has the following composition by volume :
CO_2 = 9 %, CO = 1 %, O_2 = 7.77 % and N_2 = 82. 23 % .
Determine the air-fuel ratio.

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