3RD SEM./MECHANICAL/AERO./AIRCRAFT MAINT./ AUTO./DIP IN MECH./MECH(MAINT.)/MECH(PROD./ MECH(SAND.) /MECH(IND INT.)/ 2024(W)

TH4 Thermal Engineering-I

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. Differentiate between closed system and open system.

   b. Classify and explain the IC engines according to the type of fuel used.

   c. Define Free expansion.

   d. Draw the P-V and T-S diagram for Carnot cycle.

   e. Define Cetane number.

   f. Illustrate Zeroth law of thermodynamics.

   g. Define heat engine.

   h. Write and explain the statement of Boyle's Law.

   i. What are the limitations of 1st law of thermodynamics?

   j. Differentiate between Path function and Point function.

2. Answer **Any Six** Questions 5 x 6

   a. What is Quasi-static process? Explain with diagram.

   b. Derive the relationship between C_p, C_v and R.

   c. A cyclic heat engine operates between a source temperature of 827˚C and a sink temperature of 37˚C. Calculate 2.5 x 2
      i) the thermal efficiency of the cycle
      ii) the amount of heat supply if the net work output is 5 J.

   d. Derive the expression for the work done of an isothermal process.

   e. A quantity of gas has a volume of 0.2 m^3, pressure of 2 bar and a temperature of 100^0 C. If the gas is compressed at a constant pressure to a volume 0.15 m^3 then calculate 2.5 x 2
      i) Work done in KJ
      ii) The temperature at the end of compression

   f. Differentiate between 2-stroke engine and 4-stroke engine.

   g An engine working on the Otto cycle has a cylinder diameter of 150mm and a stroke length of 250 mm. Calculate the air standard efficiency if the clearance volume is 1.5×10^{-3} m^3 and $\gamma = 1.4$

Answer **Any Three** Questions

3.	Illustrate the working of 4-stroke diesel engine with diagram.	10
4.	Derive the steady flow energy equation. Write its application to turbine.	7+3= 10
5.	A certain quantity of air has a volume of 0.03 m^3 at a pressure of 1.3 bar and temperature of 25^0 C. It is compressed to a volume 0.004 m^3 according to the law $pv^{1.3}$ = constant. Calculate i) The final temperature ii) The final pressure iii) Work done during compression	3+3+4
6.	Illustrate diesel cycle with P-V and T-S diagram and derive its ideal efficiency.	10
7.	Write short notes on- i) Mechanical equivalent of heat ii) Co-efficient Of Performance iii) Fuel and its classification iv) Enthalpy	2.5 x 4 = 10