

**PNS School of Engineering & Technology**  
 Nishamani Vihar, Marshaghai, Kendrapara  
**Internal Assessment Examination-2022(3rd Semester)**  
**Subject : Th-4-Thermal Engineering-I**  
**Branch : Mechanical Engineering**

1. Answer the following questions (any Five). [2 x 5]

(a) Define first law of thermodynamic.

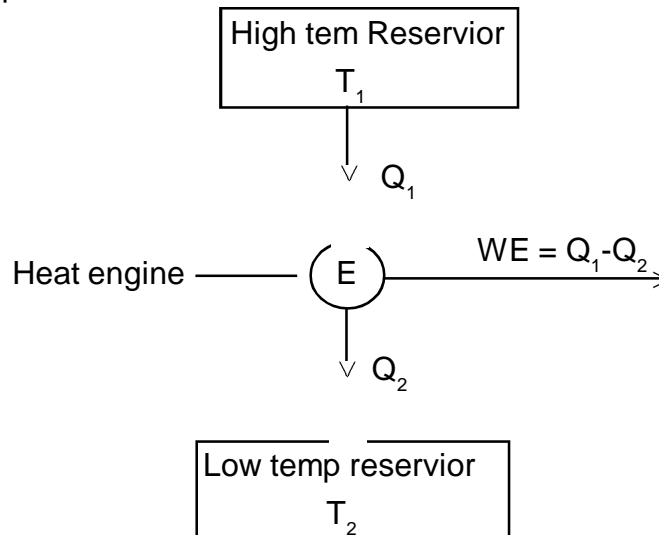
Ans. (i) This law stated as when a close system undergo a thermodynamic cycle the net heat transfer is equal to the net work transfer.

(ii) The energy can neither be created nor be destroyed but it can transfer, from one to another.

(b) Define Kelvine planck statement.

Ans. (i) According to this statement it is impossible to construct and engine work on a cyclic process. Whose sole purpose is to convert heat energy from thermal reservoir into equivalent amount of work.

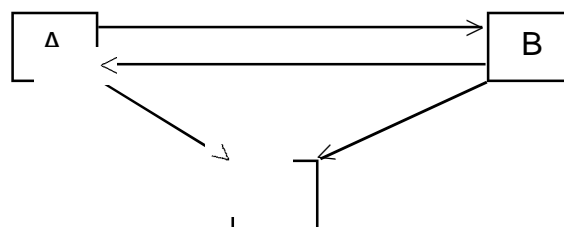
(ii)



(c) State Zeroth Law of thermodynamic.

Ans. (i) When two system are thermal equilibrium with a third system, then two system are thermal equilibrium with each other.

(ii)



(d) Define thermodynamic system & classify it.

Ans. (i) Thermodynamic System : - A definite area or region where some thermodynamic process takes place.

(ii) Thermodynamic system is classify into three types : (a) Closed system,  
 (b) Open system (c) Isolated system.

(e) What is thermodynamic process & state ?

Ans. (i) Thermodynamic Process : When a system changes its state from one equilibrium stage to another equilibrium stage is known as thermodynamic process.

(ii) Thermodynamic State : A system is said to be exist in a definite state if all the properties of the system have fixed value.

(f) Various types of thermodynamic process.

Ans. (i) There are seven types of thermodynamic process.

- (ii) (a) Reversible process (b) Irreversible process (c) Isothermal process  
 (d) Isochoric process (e) Cyclic process (f) Isobaric process  
 (g) Adiabatic process

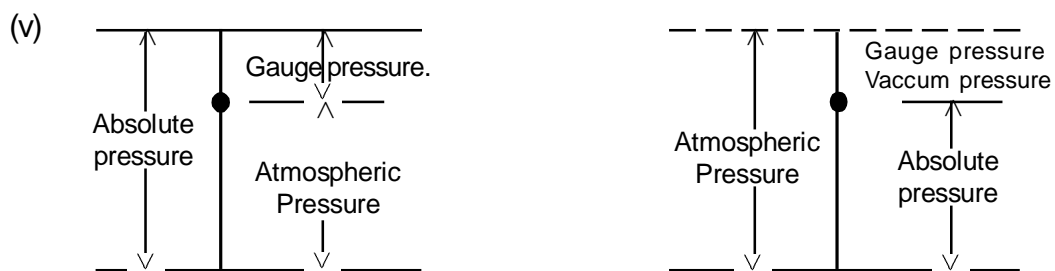
(g) Define absolute pressure, atmospheric pressure and gauge pressure also write relation between them with neat sketch.

Ans. (i) Absolute Pressure :- The actual pressure is called absolute pressure.

(ii) Gauge Pressure :- The reading of the pressure gauge is known as gauge pressure.

(iii) Atmospheric Pressure :- The pressure recorded by the barometer of atmosphere is known as atmospheric pressure.

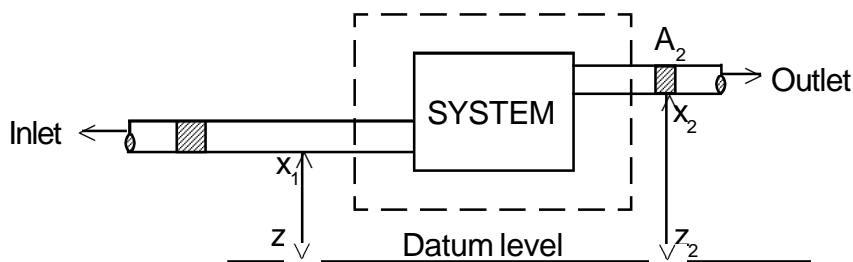
(iv) Absolute pressure :- Atmospheric pressure + Gauge pressure.



2. Answer the following questions (any Two)

[5 x 2]

(a) Drive steady flow energy equation.



Consider a steady open system in which working substance is flow at the steady rate. The working substance is enter the system (1) one and leave at the system(2).

Let  $P_1$  = Pressure of the working substance at section(1)

$PS_1$  = Pressure of the substance at section (1)

$VS_1$  = Specific volume of substance at section (1)

$V_1$  = Velocity of the working substance at the section (1)

$U_1$  = Internal energy of the working substance at section (1)

$Z_1$  = High above the datum level at section (1)

$P_2, PS_2, VS_2, V_2, U_2, Z_2 =$  Corresponding value at section (2)

$q_{1-2}$  = Heat supply to the system in J/kg.

$w_{1-2}$  = Work deliver by the system in J/kg.

Consider 1kg mass of working substance we know that total energy enter the system per kg of working substance.

$e_1$  = Internal energy + displacement energy + kinetic energy + potential energy + Heat supply.

Mathematically,

$$e_1 = U_1 + P_1VS_1 + \frac{V_1^2}{2} + gZ_1 + q_{1-2}$$

Again, Total energy leaving the system

$$e_2 = U_2 + P_2VS_2 + \frac{V_2^2}{2} + gZ_2 + W_{1-2}$$

Assuming know, less of energy then. According to 1st law of thermodynamics.

$$e_1 = e_2$$

$$\Rightarrow U_1 + P_1VS_1 + \frac{V_1^2}{2} + gZ_1 + q_{1-2} = U_2 + P_2VS_2 + \frac{V_2^2}{2} + gZ_2 + W_{1-2}$$

- (b) In a condenser of a steam power plant the vacuum is recorded 800mm of mercury. If the barometer reading 760mm of mercury. Find the absolute pressure in the condenser in N/m<sup>2</sup>. KPa and N/mm<sup>2</sup>.
- (c) A cold storage is maintain at temp - 5<sup>0</sup>c which surrounding temp 35<sup>0</sup>c. The heat leakage from surrounding to cold storage 25KW. Find power required to drive the unit.

