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Module :- 7th

Subject :- Basic Electro Mech Subject

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to

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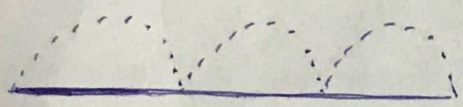
FINAL TERM EXAM.

Q1) a) What is Diode ? Differentiate b/w Half wave rectification & Full waves rectification.

"Diode :-"

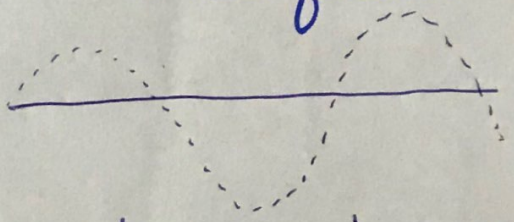
Diode is an electronic component which limits the current in one direction. It consists of anode & cathode respectively.

Half wave Rectification



- The flow is in interval which shows there is a gap region between two adjecent waves
- $r_D < R$

Full wave Rectification



- A regular waveform is seen thus this is a continous waveform
- $R > 0$

b) Given Data :-

$T = 785C^\circ$

$mass = 97.0g$

$T = 15.0C^\circ$

$mass = 323g$

Sol:-

$$-\text{Lose heat} = \text{Gain heat}$$

$$\Rightarrow -[(C_{Au})(mass)(\Delta T)] = (C_{H_2O})(mass)(\Delta T)$$

$$\Rightarrow -[(0.129\ J/g^\circ C)(97g)(T_f - 785^\circ C)] = (4.184\ J/g^\circ C)(323g)(T_f - 15^\circ C)$$

$$\Rightarrow -[(12.5)(T_f - 785^\circ C)] = (1.35 \times 10^3)(T_f - 15^\circ C)$$

$$\Rightarrow -12.5\,T_f + 9.82 \times 10^3 = 1.35 \times 10^3 T_f - 2.02 \times 10^4$$

$$\Rightarrow 3 \times 10^4 = 1.36 \times 10^3 T_f$$

$$\Rightarrow \boxed{T_f = 22.1^\circ C}$$ Ans-

Q2 a) Explain the Isobaric process. Isometric process Isothermal process & adiabatic.

Isobaric Process:- "It is a system of energy in which the pressure remains constant, there is a increase in heat energy with the increase in the internal energy.

$$\Delta Q = \Delta U + \Delta W$$

ii) "Isochmetric process:-"

In this system - there is no change in the volume i.e volume is Constant

$$\Delta Q = \Delta U + \Delta W^{0}$$

$$\Delta Q = \Delta U$$

iii) "Isothermal Process:-"

In this system, there is a Constant temperature thus $\Delta U = 0$ So

$$\Delta Q = \Delta W$$

iv) "Adiabatic Process:-"

In this system, no energy is being taken inor out of the system thus

$$\Delta W = -\Delta U$$

-ve sign indicates the gain in energy-

b) Soln:-

$$e = 1 - \frac{T_c}{T_4}$$

$$e = 1 - \frac{300k}{500k}$$

$$\boxed{e = 40\%}$$

Actual $e = 0.5\, e_i = 20\%$

$$e = \frac{W}{Q_H}$$

$$W = eQ_H = 0.20\,(600J)$$

Work = 120J

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(13) 9) **Differentiate b/w internal Combustion engine & external Combustion engine.**

Internal Combustion engine	External Combustion engine.
• Temperature is higher	• Temperature is lower.
• Pressure is higher	• Pressure is lower.
• It is costly	• It is cheaper Comparatively.
• less time required to start	• More time required to start
• Fuel tank required to start	• Water storage required to generate steam.
• Pressure generate inside the engine is due to Combustion of fuel.	• Pressure generated inside the engine is due to steam of water.

(6) Sol:-

$\Delta Q = 0$

Find P_B $\rightarrow$ $P_B = P_A \left(\frac{V_A}{V_B}\right)^{\gamma}$

$P_B = P_A \left(\frac{12 V_B}{V_B}\right)^{1.4}$

$P_B = (1\,atm)(12)^{1.4}$

$P_B = 32.4$ atm or 3284 KPa

Now Find T_B

$\Delta Q = 0$

$(1\,\text{adiabatic}) \quad \frac{P_A V_A}{T_A} = \frac{P_B V_B}{T_B}$

$\frac{(1\,atm)(12 V_B)}{(300K)} = \frac{(32.4\,atm)(1 V_B)}{T_B}$

$T_B = 810K$

Q4 (6)

a) Differentiate b/w Conduction & Convection.

Conduction	Convection
• The movement or increase in kinectic from higher Concentration to region of low Concentration.	• The flow of energy in the same direction of the liquid or gas.
• It happen in solid.	• More the kinectic energy more will be Convection.
• Transfer of heat occurs due to localized electrons.	• Example: Heat transfer from hot surface to air is type of Convection.
• Continous until object temperature are equal.	• Cycle occurs while temperature difference exist.

b) Sol:-

$$Q_{water} = -Q_{PD}$$

$$m_{water} C_{water} \Delta T_{water} = -(m_{PD} C_{PD} \Delta T_{PD})$$

$$125(4.18)(T_f - 23) = -75(0.13)(T_f - 435)$$

$$522.5 T_f - 12017.5 = -9.75 T_f + 4241.25$$

$$+9.75 T_f + 12017.5 \qquad +9.75 T_f + 12017.5$$

$$532.25 T_f \qquad 16258.75$$

$$T_f = 30.5 C^\circ$$

(Q5) **Sol:-** The inner and outer surface of the flat concrete roof of an electrically heated home are maintained at specific temperature during a night - The heat loss through the roof and its cost that night are to be determined.

Assumption 1: Steady operating exists during the entire night since the surface temperatures of the roof remain constant at the specified value -

Assumption 2: Constant properties can be used for the roof -

Properties: The thermal conductivity of the roof is given by $K = 0.8\ W/m.C^\circ$

Analysis: a) Nothing that heat transfer through the roof is by conduction & the area of the roof is

$A = 6m \times 8m = 48m^2$, the steady rate of heat transfer through the roof is

$$Q = KA\frac{T_1 - T_2}{L} = (0.8\ W/m)(48m^2)\frac{(25-0)C^\circ}{0.25m} = 3.84KW$$

b) The amount of heat lost through the roof during a 10 hours period and its cost is

$$Q = QDt = (3.84KW)(10h) = 38.4\ KWh$$

$$Cost = (Amount\ of\ energy)(unit\ cost\ of\ energy)$$
$$= (38.4\ KWh)(0.2/KWh) = \$\ 7.68$$

"Discussion:-" The cost to the home owner of the heat loss through the roof that night was $7.68 - The total heating bill of the house will be much large since the heat losses through the walls are not considered in these calculations.

The End.