Q.1. part A:

What is Divode?. Differentiate b/w Half-wave rectification and full wave-rectification.

Answer:

Divode:

A divode is an electronic component that;

- which has two terminals.
- Limits current to one direction.

* Divodes have an anode & Cathode.
* positive current normally flows from the anode to Cathode.
* Divodes are usefull for protecting circitry from harmful voltage or current.
* Divodes are a basic building block of the charge- collecting element in many detectors.

Scanned with CamScanner

Half-wave rectifier

=> Half wave rectifier

=> Equalent circute of ~~the Half-wave~~ rectifier with the divode replaced with its battery-plus-resistance model.

=> Transfer Charracteristics of the rectifier circute.

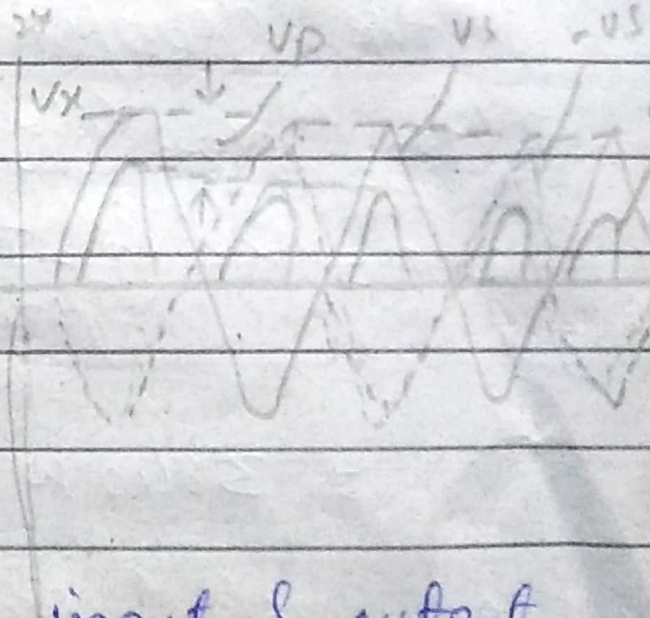
=> Input and output waveforms assuming that $r_D << R$

Full-wave rectifier.

=> have a circute

=>

=> Transffer Characteristic assuming a Constant-voltage-drop model for the diodes.

=> 

=> input & output wave forms.

Q. 1 part b

Solution:

$$-\text{Loss}_{heat} = \text{Gain}_{heat}$$

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

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

$$\Rightarrow -[(12.5)(T_f - 785^\circ C)] = [(1.35\times10^3)(T_f - 15^\circ C)]$$

$$\Rightarrow -12.5\ T_f + 9.82\times10^3 = 1.35\times10^3 T_f - 2.02\times10^4$$

$$\Rightarrow 3\times10^4 = 1.36\times10^3 T_f$$

$$\Rightarrow T_f = 22.1^\circ C$$

Scanned with CamScanner

Q:5 ~~Example~~ Part:

Solution:

Nothing that heat Transfer through the roof is by Conduction and the area of the roof is

$A = 6m \times 8m = 48m^2$

the Steady rate of heat transfer through the roof is determined to be;

$$\dot{Q} = KA(T_1 - T_2)/L = (0.8)(48)(25-0)/0.25$$

$= 3840\ W = 3.84\ KW$

The amount of heast lost through the roof during a 10 hours period and its cost are determine from;

$Q = \dot{Q} \cdot \Delta t = (3.84\ kW)(10h) = 38.4\ kWh$

Cost/day = (Amount of energy)(unit cost energy)

= (38.4 kwh)(\$0.2/kWh

= \$ 7.68

Cost of month = (cost/day) × (30 day/month) =

\$ 7.68 × 30 = **\$ 230.4** Ans

Q. 2 part b

~~Example~~:

~~Solution~~: A steam engine absorbs 600j of heat at 500 K and the exhaust temprature is 300K. If the actual efficiency is only half of the ideal efficiency, how much work is done.

Solution:

$$e = 1 - \frac{T_L}{T_H}$$

$$e = 1 - \frac{300\,K}{500\,K}$$

$$e = 40\%$$

Now

Actual $e = 0.5 e_i = 20\%$

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

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

$$\boxed{\text{work} = 120\,j}$$ Answer.

Scanned with CamScanner

Q. 2 Part A

(1) Isobaric Process:

An Isobaric process is a thermodynamic process taking place at constant pressure. This basically nutralizes any pressure change due to the transfer of heat. In an isobaric process, when the heat is transfered to the system some work is done. However, there is also a change in the internal energy of the system.

Isobaric process:

Constant pressure, $\Delta p = 0$

$\Delta Q = \Delta U + \Delta W$ But $\Delta W = P\Delta V$

Heat In = W_{out} + increase internal enegy

Heat out = W_{out} + Decrease internal energy

Isobaric work formular:

work = Area under PV Curve

$$W = P\Delta V$$

Isomatric process:

Ans Isometric process also Called Constant volume process, (or) and Isochoric process, is a thermodynamic process during which the volume of the closed system undergoing such a process remains constant.

Constant volume, $\Delta V = 0$, $\Delta W = 0$

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

Heat IN = Increase in Internal engy.
Heat out = Decrease in internal energy.

Isothermal process:

An isothermal process is an thermodynamic process in which the tempreture of a system remains constant. The transfer of heat into (or) out of the system happens so slowly that thermal equilibrium is maintained.

Scanned with CamScanner

Isothermal Process.

Const. Temprature, $\Delta T = 0$, $\Delta U = 0$

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

Net heat input = work output.

work input = Net heat output.

Isothermal work formulae:

$$W = nRT \ln \frac{V_B}{V_A}$$

Adiabatic Process:

An adiabatic process occure without transfering heat (or) mass b/w a thermodynamic System and it surrounding, unlike an isothermal process and adiabatic process to transfer energy to the surrounding only as work.

No Heat Exchange, $\Delta Q = 0$

$\Delta Q = \Delta U + \Delta W$; $\Delta W = -\Delta U$ (or)

$\Delta U = -\Delta W$.

Scanned with CamScanner

$\Delta W = -\Delta U$ $\qquad$ $+\Delta U = -\Delta W$.

$\boxed{-\Delta U}$ → work out $\qquad$ $\boxed{+\Delta U}$ ← work in

$\Delta Q = 0$.

work done at expense of internal energy

Input work increases internal energy.

Adiabatic expansion formula:

$$P_A V_A^{\gamma} = P_B V_B^{\gamma}.$$

Q.3:

Part A:

Differentiate b/w Internal Combustion engine and external Combustion engine.

Internal combustion engine	External Combusting engine
→ Name itself says that combustion take place inside the cylinder	→ Name itself says that combustion take place out side the cylinder
→ Temprature is heigher	→ temprature is lower.
→ pressure is higher	→ pressure is lower.
→ Efficiency is higher	→ Efficiency is lower
→ In IC engine, piston and conecting rod is used	→ In EC engine, stuffing box is used.

Scanned with CamScanner

→ Lighter in weight	→ Heavy in weight
→ IC engine is Costly	→ In EC engine is ~~cheaper~~ cheaper Compar to IC engine
→ Less time required to Start	→ More time required to start
→ pressure generated inside the engine is due to combustion of fuel	→ pressure generated inside the engine is due to Steam of water
→ Fuel tank required to store fuel.	→ Boiller and water Storage required to general Steam

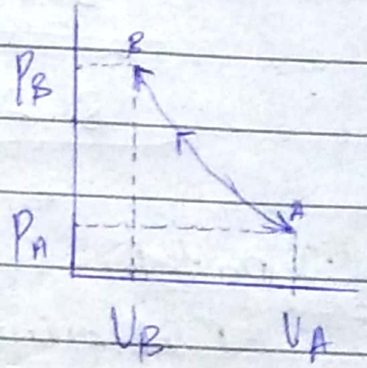
Scanned with CamScanner

Q.3 part b

A diatomic gas at 300k and 1 atm is compressed adiabatically, decreasing its volume by 1/12 : ($V_A = 12 V_B$). What is the new pressure and temprature? ($\gamma = 1.4$).

Sol:

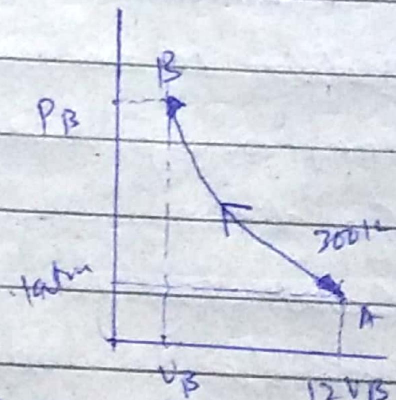
$\Delta Q = 0$



$P_A V_A^{\gamma} = P_B V_B^{\gamma} \rightarrow$ (i)

$\frac{P_A V_A}{T_A} = \frac{P_B V_B}{T_B} \rightarrow$ eq (ii).

Now from eq (i).



$P_A V_A^{\gamma} = P_B V_B^{\gamma}$

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

Now put values.

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

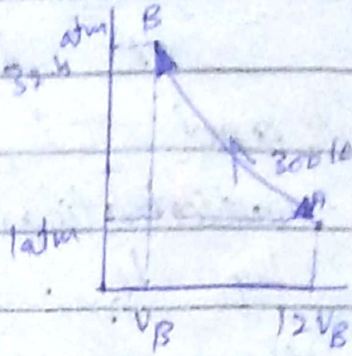
$P_B = 1 \text{ atm } (12)^{1.4}$.

$P_B = 32.4$ atm

or 3284 kpa.

Scanned with CamScanner

Now for $T_B = ?$



$$\frac{P_A V_A}{T_A} = \frac{P_B V_B}{T_B}$$

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

$$\boxed{T_B = 810\,K}$$ Answer

Q (4). part A

Differentiate between conduction and convection.

Conduction	Convection.
→ Medium is necessory for transfer of heat by condition	→ Medium is necessory for transfer of heate by convection.
→ Conduction is not possible in vacum.	→ Convection is not possible in vacum.
→ The molecules of the medium do not leave their mean positions.	→ The molecules of the medium do not leave their mean position

They transfer heat by vibrating about their mean position.	and move upward direction carrying heat from the Source.
→ The transfer of heat Can be in any direction	→ The transfer of heat is in vertical upward direction.
→ The process is slow	→ The process is faster than the Condition.

Q.4 part b.

Solution:

$$Q_{water} = -Q_{Pb}$$

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

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

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

$$+9.75\,T_f + 12017.5 = +9.75\,T_f + 4241.25$$

$$532.25\,T_f = 16258.75$$

$$\boxed{T_f = 30.5\,^\circ C}$$

Answer

Name Imad Ahmad

ID 16082

Section A

Subject Basic Electromechanical

Submitted to engr Ashraf Ali.

Scanned with CamScanner