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K.S. GROUP OF INSTITUTIONS

K.S. SCHOOL OF ENGINEERING & MANAGEMENT

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KSSEM

BLUE BOOK

Name of the Student: A. Yuvasree

Class / Sem : D/1 Branch: Eee

USN : 1 K G 2 0 E C D 0 2

SUBJECT : Engineering chemistry Subject Code : 18CHE12

MAXIMUM MARKS : 30+10=40

Test	I	II	III	Average Marks Obtained
Date	28-01-21	26-02-21	25-03-21	30+10 / 40
Marks Obtained	29	30	30	
Signature of the Student	A. yuvasree	A. yuvasree	A. yuvasree	
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY :

SIGNATURE :

SIGNATURE OF H.O.D.

K S SCHOOL OF ENGINEERING AND MANAGEMENT

First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	5	CO_1	CO_1	20
1(b)			3(b)	5	CO_1		
1(c)			3(c)	5	CO_2	CO_2	9
OR			OR				
2(a)	5	CO_1	4(a)				
2(b)	5	CO_1	4(b)				
2(c)	4	CO_2	4(c)			**Grand Total**	29

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	5	CO_2	CO_2	10
1(b)			3(b)	5	CO_3		
1(c)			3(c)	5	CO_3	CO_3	20
OR			OR				
2(a)	5	CO_2	4(a)				
2(b)	5	CO_3	4(b)				
2(c)	5	CO_3	4(c)			**Grand Total**	30

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	CO_4	3(a)			CO_4	20
1(b)	5	CO_4	3(b)				
1(c)	5	CO_5	3(c)			CO_5	10
OR			OR				
2(a)			4(a)	5			
2(b)			4(b)	5			
2(c)			4(c)	5		**Grand Total**	30

Signature of the Staff

2)a. Given

The emf of the cell constructed by immersing two silver electrode in 0.001M and 1.0M solution

cell reactions

At Anode

$$Ag \longrightarrow Ag^+(c_1) + 1e^-$$

At cathode $Ag^+(c_2) + 1e^- \rightarrow Ag$

overall cell reaction

$$Ag^+(c_2) \longrightarrow Ag^+(c_1)$$

cell representation

$$Ag/Ag^+(c_1) \,//\, Ag^+(c_2)/Ag$$

Emf of the cell

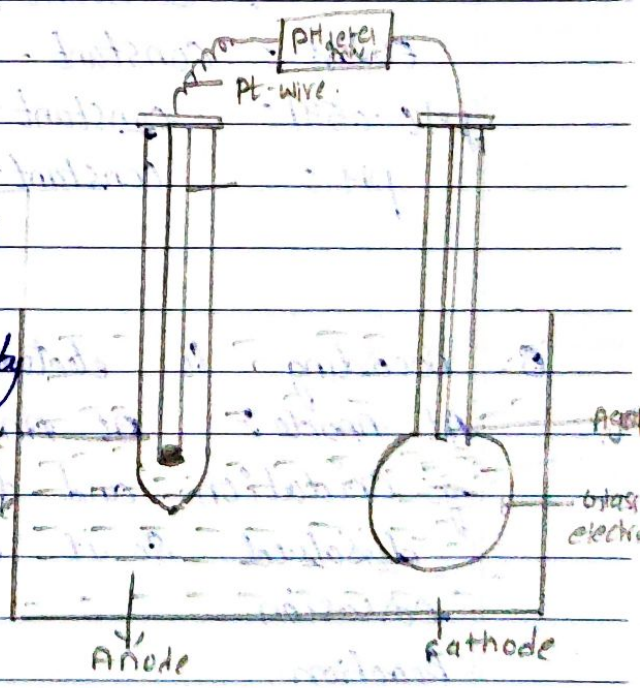
$$E_{cell} = \frac{0.0591}{n} \log\left[\frac{c_2}{c_1}\right]$$

$$E_{cell} = \frac{0.0591}{1} \log\left[\frac{1.0M}{0.001M}\right]$$

$$E_{cell} = 0.1773V$$

b. Glass electrode :-

Glass electrode is made up of special glass which has low melting point and high electrical conductivity an AgCl-Ag electrode is immersed in 0.1M HCl and it act as internal reference electrode and conducts electrical contact



principle :

when a glass electrode is placed between solutions of two different pH. The potential differences arises. The potential differences arises is change if the pH of the solutions varies one of the pH of solution is kept constant. and the electrode potential is depend on another pH that is experimental solution.

Representation

$Hg/Hg_2Cl_2/Cl^- // solution\ of\ unknown\ pH / glass / 0.1M\ HCl / AgCl / Ag$

working.

The electrodes is immersed in constant pH solution which to be determined and it is combined reference electrode.

$E_{cell} = E_{cathode} - E_{Anode}$

$E_{Glass} = E_{glass} - ESE$

$E_{Glass} = E_1 - E_2$

$= E^\circ + 0.0591 \log(C_1) - [E^\circ + 0.0591 (C_2)]$

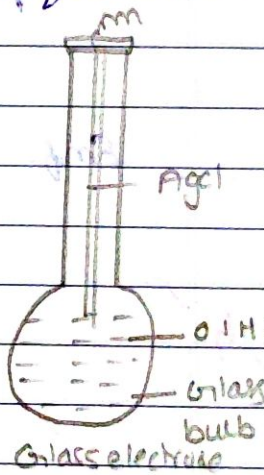
$= 0.0591 \log(C_1) - 0.0591 \log(C_2)$

$= constant + 0.0591 \log(C_1)$ $\quad C_1 = H^+$

$E_{Glass} = constant - 0.0591\, pH$ $\quad pH = -\log(H^+)$

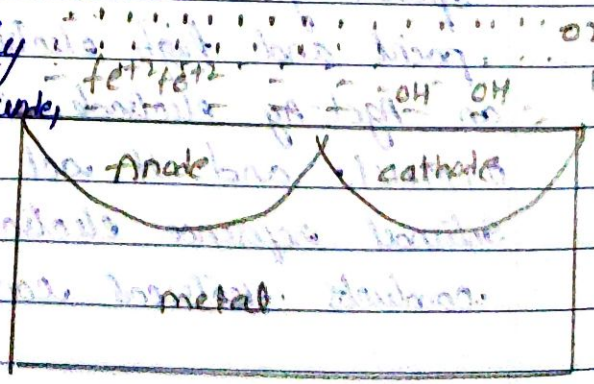
$pH\ 0.0591 = constant - E_{cell} - ESE$

$pH = \frac{constant - E_{cell} - ESE}{pH}$



8. According to electrochemical theory

At Anode :- At anode the metal undergo oxidation and Fe^{+2} ions are dissolved so it leads to corrosion Reaction.



$Fe \rightarrow Fe^{2+} + 2e^-$

At cathode:-

At cathode region corrosion does not take place

Liberation of Hydrogen

At acidic medium

$2H^+ \rightarrow +2e^- \rightarrow H_2 \uparrow$

At neutral

$2H_2O + 2e^- \rightarrow 2OH^- + H_2$

Absorption of oxygen

$2H^+ + O_2 + 2e^- \rightarrow H_2O$ (At acidic medium)

At neutral

$H_2O + O_2 + 4e^- \rightarrow 4OH^- + H_2$

Overall reaction = ?

PART-B.

3.(a)

Nernst equation gives the relation between single electrode potential and standard electrode potentials at the ion concentration at the particular temperature

$-\Delta G = W_{max}$

gibbs free energy. The maximum energy that can be obtained from chemical reactions

$W_{max} = nFE$

$-\Delta G = nFE$

$-\Delta G^\circ = nFE^\circ$

n = no of electrons. F = Faraday constant E° standard potential

Vantoff's reaction

$-\Delta G = -\Delta G^\circ - RT \ln K_c$

$nFE = nFE^\circ - RT \ln K_c$

$\div nF$

$E = E^\circ - \frac{RT}{nF} \ln K_c$

Kc is an equilibrium constant

$$E = E^\circ - RT \ln\left[\frac{M}{M^{n+}}\right]$$

M = 1 for metal solid concentration

$$E = E^\circ - RT \ln\left[\frac{1}{M^{n+}}\right]$$

$$E = E^\circ + \frac{RT}{nF} \log[M^{n+}]$$

$$E = E^\circ + \frac{2.303RT}{nF} \log[M^{n+}]$$

R = 8.314 T = 298K F = 96500

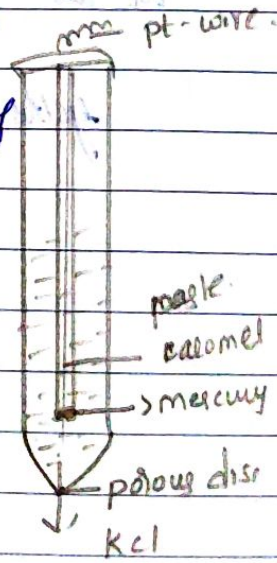
$$E = E^\circ + \frac{0.0591}{n} \log[M^{n+}]$$

∴ Nernst equation for single electrode potential

$$E = E^\circ + \frac{0.0591}{n} \log[M^{n+}]$$

b.

* calomel electrode consists of mercury is placed at the bottom of the tube and a paste of mercury and mercous chloride is placed and the above the space is filled KCl and platinum electrode is connected for electrical contact porous disc acts as a salt bridge.



Representation

$$Hg \mid Hg_2Cl_2 \mid Cl^-$$

At Anode

$$Hg \rightarrow Hg_2^{2+} + 2e^-$$

$$Hg + Cl^- \rightarrow Hg_2Cl_2$$

$$Hg_2Cl_2 \rightarrow 2Hg + Cl^-$$

$Hg_2Cl_2 \rightarrow Hg_2^{2+} + 2e^-$

At cathode

$Hg_2^{2+} + 2e^- \rightarrow Hg$

$Hg_2Cl_2 \rightarrow Hg_2 + Cl^-$

$Hg_2Cl_2 + 2e^- \rightarrow 2Hg + Cl^-$

overall reaction

$Hg_2Cl_2 \rightarrow Hg_2^{2+} + Cl^-$

c The factors on rate of corrosion

(a) Ratio of anodic to cathodic areas:

→ The corrosion takes place due to smaller the anodic and larger the cathodic region leads to faster corrosive environment

(b) nature of corrosion product:-

→ if the corrosive product is unsoluble, stable, unporous it prevents the further corrosion and it forms a protective film barrier. The product film barrier will act as barrier between the fresh metal and corrosive part Ex:- Al

→ if the corrosive product is solute, unstable, porous it does prevent the further corrosion process. ex: Iron.

(c) nature of metal.

The metal which has low electrode potential will act as anode and which has high electrode potential will act as cathode. The anode region undergo corrosion

Ex Zn and gold

Zn will act as anod undergo corrosion but not gold.

* Conductivity: if the conductivity increases the rate of corrosion also becomes: because it transforms the electrons very faster

pH value :- The corrosion increases decrease in pH but Al, Zn the corrosive environment with higher in pH.

Temperature :- The corrosion increases with increases in temperature due to the conductivity.

2.a Metal finishing =

metal finishing can be defined as the deposition of layer of metal on the surface of the substrate or the process of converting of surface metal ion into oxide film.

* The technological importance of metal finishing.

→ An improved corrosive resistance
→ An good thermal conductivity.
→ An good electrical conductivity
→ An good thermal reflectivity
→ A good optical reflectivity
→ A good heat resistance
→ A good solidarity
→ A decorative appearance.

c. Given.

$m = 2.5g = 2.5 \times 10^{-3} kg$
$W_1 = 4.0 kg$
$W_2 = 325g = 0.325 kg$
$\Delta t = 2.5^{\circ}K$
$L = 2458 J/g$
$H = 5\%$
$S = 4.187 J/g/K.$

$$GCV = \frac{(W_1 + W_2)\,\Delta t \times S}{m}$$

$$= \frac{(4.0 + 0.325)(2.5) \times 4.187}{2.5 \times 10^{-3}} = (4.325)$$

$$= \frac{45.2719375}{2.5 \times 10^{-3}}$$

= 18108.775 kJ/kg

NCV = GCV − 0.09 × H × L

= 18108.775 − 0.09 × 5 × 2458

= 18108.775 − 1106.1

= 17002.675 kJ/kg.

c. Mechanism of knocking in petrol engine.

Knocking in IC engine

It can be defined as production of shock wave in IC engine as result of explosive combustion of fuel air mixture leads to rattling sound.

Mechanism:-

under normal condition their is a smooth oxidation of fuel.

oxygen reacts with the hydrocarbons to form the CO_2 and water

$$C_2H_6 + O_2 \rightarrow \frac{7}{2}CO_2 + 3H_2O$$

under knocking. The rate of combustion is very high. oxygen reacts with the hydrocarbons

oxygen reacts with hydrocarbons to form peroxides

$$CH_3 - CH_3 + O_2 \rightarrow CH_3 - O - O - CH_3$$

peroxides are readily decomposes to give number of gaseous

$$CH_3 - O - O - CH_3 \rightarrow CH_3 - O - CH + H_2O$$

peroxides Acetaldyde

$CH_3-O-CH + O_2 \longrightarrow HCHO + CO_2 + H_2O$

Acetaldyde formaldyde.

$HCHO + O_2 \longrightarrow CO_2 + H_2O$

5 during the fast reaction pressure increases : This causes explosive combustion of the fuel.

part-B.

3a. electroplating can be defined as the process of deposition of metal on another metal.

Electroplating technique in chromium plating.

The surface of the metal is cleaned thoroughly. Organic impurities are removed by solvent cleaning and alkali cleaning inorganic impurities are cleaned by mechanical cleaning or pickling finally the surface is cleaned by deionized water.

	decorative chromium plating	hardness chromium plating
plating bath composition	100:1 chromic and H_2SO_4	100:1 chromic acid and H_2SO_4
Temperature	45-55°C	43-66°C
current density	100-200 mA/cm³	215-430 mA/cm³
current efficiency	8-12%	10-15%
5 Anode	Insolule anode. pb sn alloy coated PbO_2	Insolule Anode pb sn alloy coated PbO_2
cathode	Article to be plated	Article to be plated.
Anode reaction	$H_2O \rightarrow 1\frac{1}{2}O_2 + 2H^+ + 2e^-$ $Cr^{3+} \rightarrow Cr^{6+} + 3e^-$	$H_2O \rightarrow 1\frac{1}{2}O_2 + 2H^+ + 2e^-$ $Cr^{3+} \rightarrow Cr^{6+} + 3e^-$
Cathode reaction	$Cr^{3+} + 3e^- \rightarrow Cr$	$Cr^{3+} + 3\bar{e} \rightarrow Cr$.
Applications	* for decorative and corrosive resistance	* for industrial and engineering purpose

b. calorific value of a fuel:

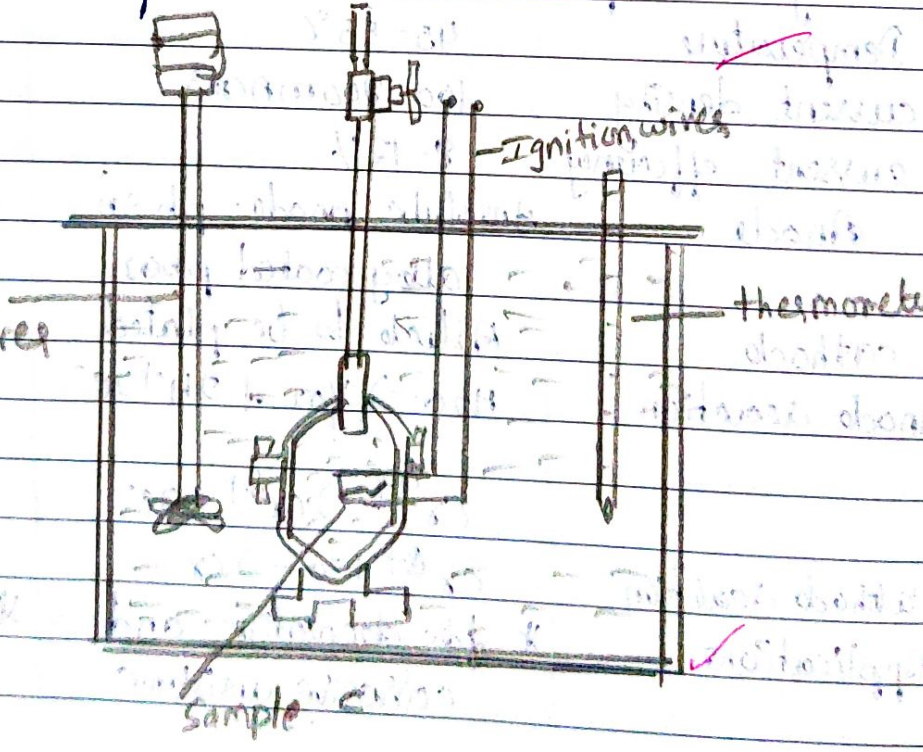
Calorific value of a fuel can be defined when unit quantity of fuel is burnt completely in the presence of air and oxygen.

→ Determination of calorific value of a solid fuel:

principle: The known mass of a solid fuel burnts in air and liberates heat. The surrounding water and calorimeter absorbs the heat. Thus the heat released by fuel is equal to the absorbed by water and calorimeter.

→ Bomb calorimeter construction.

The unknown mass of the fuel is taken in a stainless vessel. The vessel is known as bomb. The bomb has inlet valve for providing oxygen at 25 atmospheres inside the bomb and ignition coil for the combustion of a wash of fuel. The bomb is placed inside an calorimeter copper calorimeter. It has stirrer to minimize the dissipation of heat. Thermometer for measuring temperature.



Working:

The known mass of the solid fuel taken in the crucible The crucible is taken in a bomb. The lid is closed tightly and it is placed in the copper calorimeter. The known mass of the water is taken in the calorimeter and it is fielled with oxygen at 60°c and T_1 temperature is noted

When the electrical current is being passed. The fuel gets ignited and releases the heat. By using stirrering the water continously by using stirrer the water attains maximum temperature t_2 and noted

observations:

$$GCV = \frac{(W + W_2)}{m} \Delta t \, S$$

$$LCV = GCV - 0.09 \times L \times H$$

c. The production of solar grade silicon by union carbide process.

The silicon has exp substantible impurities within the tolerance limits silica is reduced to silicon by using carbon at electric heat arc furnance at 1500, 2000°C

$$SiO_2 + C \xrightarrow[2000]{1500} Si + CO_2$$

The above molton silicon is obtained is treated with air fresh silicon as flux to simply remove impurities like Ag, mg, ca

$$SiO_2 + Ag \rightarrow Ag_2O_3 + Si$$

$$SiO_2 + mg \rightarrow MgO + Si$$

$SiO_2 + CaO \longrightarrow Si + CaO$

The hydrochlorination of silicon is

$Si + yHCl \longrightarrow SiCl_4 + H_2$.

The hydrogeneration of tetrachlorosiliane is a metallugical silicon carried out in a fluryeid reactor through a bed column

$SiCl_4 + Si + H_2 \longrightarrow SiHCl_3$

The trichlorosiliane are products are formed by distbation and the unreacted tetrachlorosilane recycled back into the hydrogen reactor

the purified trichlorosilane is passed through a fixed bed column of quantay filled with ammonium ion exchanges resin acts as catalyst. The trichlorosilane converted into dichlorosilane.

$SiHCl_3 \longrightarrow SiH_2Cl_2 + H_2$.

The tetrachlorosilane is recycled back into hydrogen reactor. and trichlorosilane passed into a second fixed bed column quantay filled with ammonium ion exchanges act as catalyst dichlorosilane is converted into silicon.

$SiH_2Cl_2 \longrightarrow SiH_4 + SiHCl_3$.

$SiH_4 \longrightarrow Si + 2H_2$

solar grade silicon

The products are formed by distillation. further purification is done by the distillation and prolised to get polymers. metals, seeds rods are injected into metal jars.

30/30

INTERNAL:- 3.

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PART:- A. 16

1. sludge:

The precipitate formed in the boiler is loose and soft then it is called sludge.

formation of sludge

formation of sludge is due to presence of $CaCl_2$ & $MgCl_2$ which is highly soluble in hot water and less soluble in cool water

Removing of sludge

* Flowing off technique: Draining of the concentration of water from the bottom of the boiler

disadvantages of sludge

* It decreases the efficiency of boiler
* wastage of fuel because, sludge is poor conductor of heat

scale

The precipitate formed in the boiler is hard and strong adhere very walls of the body

formation of scale:-

* Bicarbonate converts into carbonate & precipitate out
* calcium sulphate, calcium silicate & magnesium silicate are insoluble & precipitate out directly
* magnesium undergoes hydrolysis to magnesium hydroxide & precipitate out.

removing of scale

mechanical cleaning: wood is used to remove the scale

Thermal shock: sudden heating of boiler and cooling down

Chemical treatment: Dil HCl is used to remove the scale

Blow down: Scale is removed by using the soft water

disadvantages:
* It reduces the efficiency of boiler
* boiler explosion
prevention of scale and sludge
* Softwater:- By using softy
* chemical treatment:- By adding the chemicals to the boiler

6. Given
volume of the sample $V_1 = 25 cm^3$
volume of the unreacted $K_2Cr_2O_7$ needed 6.4cm³ of 0.1N FAS $V_2 = 6.4 cm^3$
volume of the FAS in blank titration $V_3 = 28.4 cm^3$
normality $N_2 = 0.1N$.

$$COD = \frac{N_2 \times (V_3 - V_2) \times 8 \times 1000}{V_1} mg/dm^3$$

$$COD = \frac{0.1N \times (28.4 cm^3 - 6.4 cm^3) \times 8 \times 1000}{25}$$

$$= \frac{17600}{25}$$

$$= 704 mg/dm^3.$$

c. Sol Gel method.
* It is simple & low cost process.
preparation of precursor solution:-
Metalalkoxide are dissolved in alcohol followed by the addition of water. The addition of water leads to hydrolysis of alkyloxide and replaced by hydroxide ligand

$$MOR + H_2O \longrightarrow MOH + ROH$$

gel formation phase: the polycondensation of alkyloxide gives the oxo bridges and hydroxide bridges

$$2MOR + 2MOH \longrightarrow M-O-M + M-OH-M + 2ROH$$

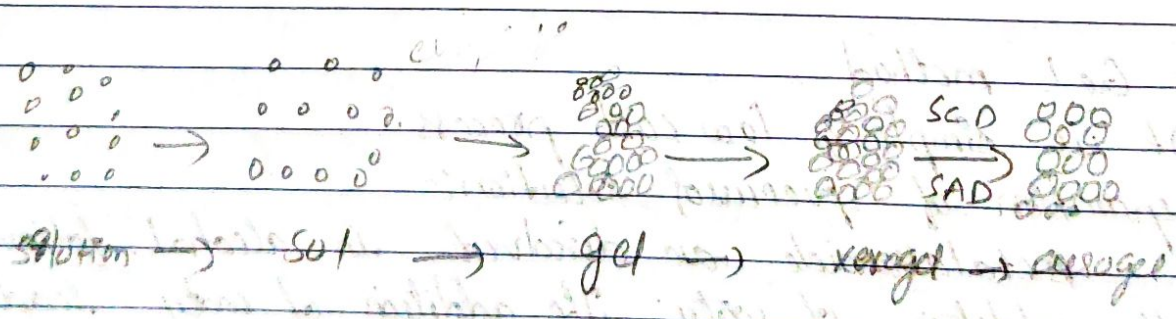
Aging of gel: the above process is till transforms until gel converts to solid mass.

Drying of gel →

* Thermal treatment: Thermal evaporated process is used to remove the water and volatile compounds present in gel and it is xerogel

super critical temperature is used to remove the water and volatile compounds present in gel and it is known as Aerogel.

finally it done by the calcining



4)a: various sources of solid waste

Residential waste: It is major source of solid waste. The waste from residential is food waste, plastic, leather, house keeping waste.

Industrial waste: Now-a-days Industrial waste is the major contribution of the solid waste: such as food waste plastic, leather, glass etc

commercial waste:- commerical such as houses, restaurants building, malls hotels. The waste from this is house keeping waste, food waste, leather, food packing covers, glass, plastic

construction waste:- construction such as buildings & destroy of buildings The waste from this is iron, steel, copper, metals, glass

Institutional wastes:- Institutional such schools, colleges centres, military, prison government centres the waste is food, glass, leather, plastic

~~e- waste:- It is~~

municipal cleaning waste:- street cleaning waste, sewage water treatment.

e- waste:- e waste are electrical and electronic wastes such as monet which can't be used no longer time such as monitors, computers, mobile phones, socket

Bio-medical waste:-

It is produced due in less diagonis and treatment of humans and animals

sources:- from house clinic, hospitals, medical shops

effects: It has non radiative metals, heavy metals non biodegradable matter

4. b The steps involved in primary treatment of sewage water is

* primary treatment:

It is physical process of removing suspended particles

screening: It is the first stage of the physical process and large size particles removed from the sewage water pass through the bar screens. The size particles are removed.

Oil & grease removal

* Oil & grease are most occurence in sewage water
* A skimming tank is designed so that the oil and grease are rise top of the water until it is removed The oil are grease are removed.

Slit & grit method.

The water is passed through the grit chamber so that the suspended particles are removed.

sedimentation (plain Sedimentation): The process of removing suspended particles from the sewage water due to the influence of the gravitation

secondary treatment

it involves the aerobic oxidation of Organic matter The water after primary treatment is passed through the subjected extension the the aeration of suspended particles The aerobic oxidation of biodegradable compounds into simple compounds

* Now water is free from biodegradable impurities

Tertiary treatment

The almost all impurities are removed in this method.

phosphates: phosphates are converted into calcium phosphate

by addition of lime

sedimentation:- The process of involving removing colloidal particles by adding chemicals. The chemicals called coagulants. The coagulants reacts with water to form flocks. The flocces absorbs the suspended particles and forms bigger flocks. $Ag(SO4) + Ca(CHO3)_2 \rightarrow Ag(OH)3 + CaSO4 + CO_2$

filteration:- The water is passed through the sand filled bed. The bed retain the particles. Now water has high level clarity

degasification:- The process of removing dissolved gases is called degasification

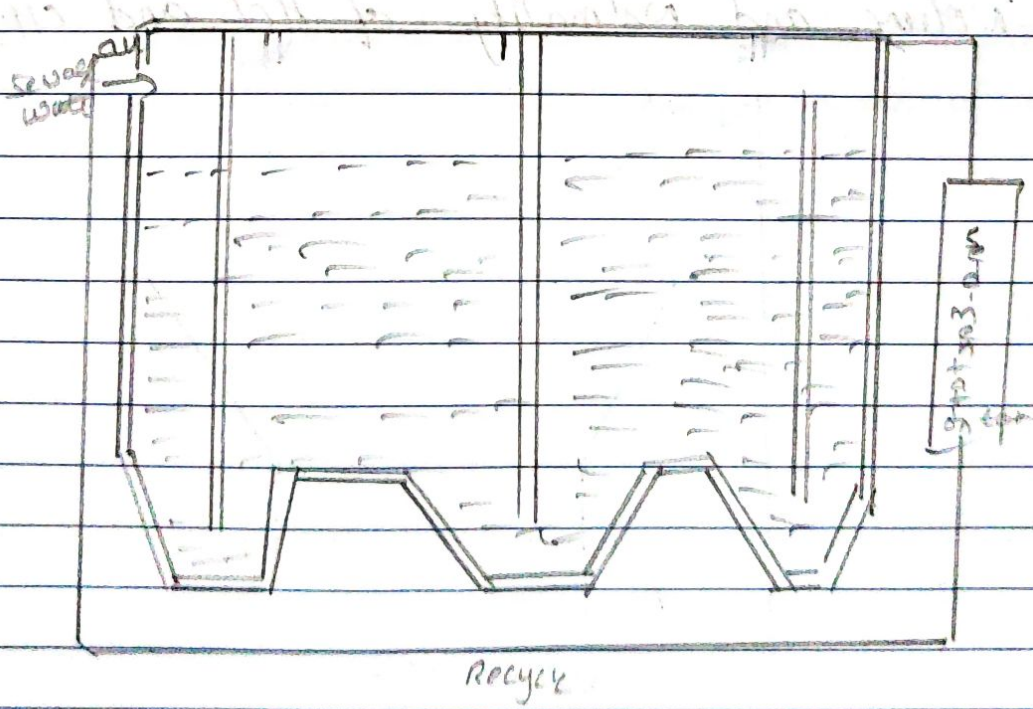
disinfectants:- The chemicals are used to killing of microorganisms is called disinfectants. The process of killing of microorganisms is called disinfection

Chlorine gas:- disinfection is achieved by addition of Cl_2

$$Cl_2 + H_2O \rightarrow HOCl + HCl$$

$$HOCl \longrightarrow HCl + O.$$

not asked.

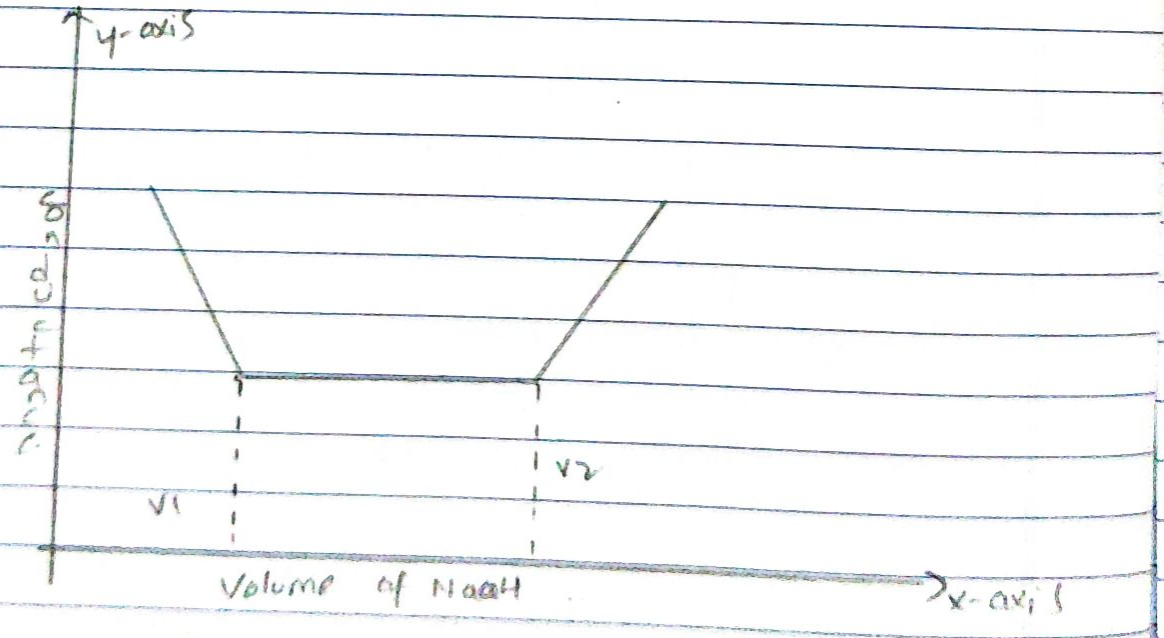


c. conductmetric principle :-

The conductance of the solution in ions of the same conductivity is replaced by ions of different conductivity.

mixture of strong and weak acid against strong base

* fill the micro burette with NaOH solution.
* pipette out 25cm³ of given acid mixture in 100ml beaker. The conductivity cell is placed in it. Now the conductivity cell is connected to the conductance meter and measure the conductance. Now add 0.5cm³ NaOH in the increments of 0.5cm³ and measure the conductance.
* plot the graph of conductance against volume of NaOH.
* The point of intersection of first and second lines the gives volume of NaOH to neutralize the only HCl and second and third gives the volume of NaOH to neutralize the HCl and CH_3COOH.
* volume and normality of NaOH. we can find the volume and normality of HCl and CH_3COOH.



* principle and theory:- The conductance of the electrolytic solution does sudden change in near end point of neutralization. However there is no sharp we can determine the neutralization by plotting the graph of conductance agai solution in burette.

Observations and calculations

Normality of HCl =

$$N_{HCl} = \frac{(N \times V)_{NaOH}}{V_{HCl}}$$

Amount of HCl present in solution = Normality x equivalent weight of HCl

Normality of CH_3COOH

$$N_{CH_3COOH} = \frac{(N \times V)_{NaOH}}{V_{CH_3COOH}}$$

Amount of CH_3COOH present in solution = Normality x equivalent weight of CH_3COOH.

30/30

B02.

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BLUE BOOK

Name of the Student: HARSHAL.V. PAI

Class / Sem : I st SEM, B SEC **Branch:** CSE

USN :

1	K	G	2	0	C	S	0	4	4

SUBJECT : MATHEMATICS **Subject Code :** 18MAT11

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date	28/01/2021	26/02/2021	25/03/2021	25 +10 35
Marks Obtained	24	20	29	
Signature of the Student	Harshal	Harshal	Harshal	Harshal
Initials of Room Supervisor	S	R		
Initials of Faculty	MKS	MKS	MKS	MKS

NAME OF FACULTY : Mandara Kumar KN

SIGNATURE :

SIGNATURE OF H.O.D.

K S SCHOOL OF ENGINEERING AND MANAGEMENT

First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	04	CO1	CO1	17
1(b)			3(b)	05	CO1		
1(c)			3(c)	03	CO2	CO2	07
OR			OR				
2(a)	03	CO1	4(a)				
2(b)	05	CO1	4(b)				
2(c)	04	CO2	4(c)			Grand Total	24

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)			CO2	05
1(b)			3(b)	03	CO3		
1(c)			3(c)	05	CO3	CO3	15
OR			OR				
2(a)	05	CO2	4(a)				
2(b)	03	CO3	4(b)	02	CO3		
2(c)	04	CO3	4(c)	04	CO3	Grand Total	20

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	05	CO4	3(a)	04	CO4	CO4	19
1(b)	05	CO4	3(b)	05	CO4		
1(c)	05	CO5	3(c)	05	CO5	CO5	10
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	29

Signature of the Staff

Part - A

2.

(a) $r = a(1 + \cos\theta)$

Apply log on both sides,

$\log r = \log\{a(1 + \cos\theta)\}$

$\log r = \log a + \log(1 + \cos\theta)$

Differentiate wrt 'θ',

$$\frac{1}{r}\frac{dr}{d\theta} = 0 + \frac{1}{1 + \cos\theta}(-\sin\theta)$$

$$\cot\phi_1 = \frac{-\sin\theta}{1 + \cos\theta}$$

$$\cot\phi_1 = \frac{-2\sin\theta/2\cos\theta/2}{2\cos^2\theta/2}$$

$$\cot\phi_1 = -\tan\theta/2$$

$$\cot\phi_1 = \cot\left(\frac{\pi}{2} + \frac{\theta}{2}\right)$$

$$\phi_1 = \frac{\pi}{2} + \frac{\theta}{2}$$

$r^2 = a^2\cos 2\theta$

Apply log on both sides,

$\log(r^2) = \log(a^2\cos 2\theta)$

$\log r^2 = \log a^2 + \log\cos 2\theta$

$2\log r = 2\log a + \log\cos 2\theta$

Differentiate wrt 'θ',

$$2\frac{1}{r}\frac{dr}{d\theta} = 0 + \frac{1}{\cos 2\theta}(-2)(\sin 2\theta)$$

$$2\cot\phi_2 = -2\tan 2\theta$$

$$2\cot\phi_2 = -2\tan 2\theta$$

$$\cot\phi_2 = -\tan 2\theta$$

$$\cot \phi_2 = -\tan 2\theta$$

$$\cot \phi_2 = \cot\left(\frac{\pi}{2} + 2\theta\right)$$

$$\phi_2 = \frac{\pi}{2} + 2\theta.$$

03

Angle of intersection,

$$|\phi_1 - \phi_2| = \left|\frac{\pi}{2} + \frac{\theta}{2}\right|$$

(b) $r^n = a^n \cos n\theta$

$$\log(r^n) = \log(a^n \cos n\theta)$$

$$\log(r^n) = \log a^n + \log(\cos n\theta)$$

Differentiate wrt 'θ'.

$$n \log r = n \log a + \log(\cos n\theta)$$

Diff wrt 'θ'

$$n \frac{1}{r} \frac{dr}{d\theta} = 0 + \frac{1}{\cos n\theta} n(-\sin n\theta)$$

$$n \cot \phi = n - \tan n\theta$$

$$\cot \phi = -\tan n\theta$$

$$\cot \phi = \cot\left(\frac{\pi}{2} - n\theta\right)$$

$$\phi = \frac{\pi}{2} - n\theta.$$

Pedal equation expression is $P = r \sin \phi$

$$P = r \sin\left(\frac{\pi}{2} - n\theta\right)$$

$$P = r \cos n\theta. \rightarrow (1)$$

From the question,

$$r^n = a^n \cos n\theta$$

$$\cos n\theta = \frac{r^n}{a^n}$$

Substitute this in (1),

$$P = r \cdot \frac{r^n}{a^n}$$

05

$$P = \frac{r^{n+1}}{a^n}$$

$$Pa^n = r^{n+1}$$

∴ The pedal eqn is given by $Pa^n = r^{n+1}$.

(c) $y = \log(1 + \cos x) \Rightarrow y(0) = \log(2)$.

$$y_1 = \frac{1}{1+\cos x}(-\sin x)$$

$$y_1(1 + \cos x) = -\sin x$$

At $x = 0$, $\Rightarrow y_1(0) = 0$.

$$y_1(2) = 0$$

$$\therefore y_1 = 0$$

Diff again,

$$y_1(-\sin x) + (1 + \cos x)y_2 = -\cos x$$

At $x = 0$

$$y_1(0) + 2y_2 = -1$$

$$y_2 = \frac{-1}{2} \Rightarrow y_2 = \frac{-1}{2}.$$

04 Diff again,

$$y_1[+\cos x] + (-\sin x)y_2 + (1 + \cos x)y_3 + y_2(-\sin x) = \sin x$$

At $x = 0$

$$-y_1(1) + y_2(0) + y_3(2) + y_2(0) = 0$$

$$0 + 0 + 2y_3 + 0 = 0 \Rightarrow y_3 = 0$$

Diff again, $y(x) = y(0) + x y_1(0) + \frac{x^2}{2!} y_2(0) \ldots$

$-y_1(-\sin x)$

$y(x) = \log 2 +$

Part - B.

3(a) $y = x + \frac{9}{x}$

$\frac{dy}{dx} = y_1 = 1 + 9\left(\frac{-1}{x^2}\right)$

$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = y_2 = 0 - 9\left(\frac{-2}{x^3}\right)$

$= \frac{18}{x^3}$

At (3, 6)

$y_1 = 1 + 9\left(\frac{-1}{3^2}\right)$

$= 1 + 9\left(\frac{-1}{9}\right)$

$= 0$

$y_2 = \frac{18}{(3)^3} = \frac{18^{\cancel{6}2}}{\cancel{27}_3} = \frac{2}{3}$.

Centre of curvature,

$\bar{x} = x - \frac{y_1(1 + y_1^2)}{y_2}$

$= x - \frac{0}{2/3}(1 + 0^2)$

$= x - \frac{3}{2}(1) = 3 - \frac{3}{2} = \frac{3}{2}$.

$$\bar{y} = y + \frac{(1+y_1^2)}{y_2}$$

$$= y + \frac{(1+0^2)}{2/3}$$

$$= y + \frac{3}{2} = 6 + \frac{3}{2} = \frac{15}{2}$$

$$\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$$

$$= \frac{(1+0^2)^{3/2}}{2/3} = \frac{1}{2/3} = \frac{3}{2}.$$

$$(x-\bar{x})^2 + (y-\bar{y})^2 = \rho^2 = \left(3-\frac{3}{2}\right)^2 + \left(6-\frac{15}{2}\right)^2 = \left(\frac{3}{2}\right)^2$$

$$\left(x - x + \frac{3}{2}\right)^2 + \left(y - y + \frac{3}{2}\right)^2 = \left(\frac{3}{2}\right)^2 \cdot = \frac{9}{4} + \frac{9}{4} = .$$

3(b) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$

The parametric equations are,

$x = a\cos t \quad y = b\sin t.$

$x = a\cos t$ $\qquad$ $y = b\sin t$

$\frac{dx}{dt} = -a\sin t$ $\qquad$ $\frac{dy}{dt} = b\cos t.$

$\frac{dy}{dx} = \frac{dy}{dx} \Big/ \frac{dt}{dt}, \; y_1 = \frac{b\cos t}{-a\sin t} = -\frac{b}{a}\cot t.$

$$\bar{x} = x - \frac{y_1(1+y_1^2)}{y_2}$$

$\bar{x} = a\cos t -$ $\qquad$ $y_2 = \frac{d}{dx}\left(-\frac{b}{a}\cot t\right)$

$$-\frac{b}{a}(-\operatorname{cosec}^2 t)\frac{dt}{dx}$$

$$\frac{b}{a}\operatorname{cosec}^2 t \frac{1}{-a\sin t}$$

$$= -\frac{b}{a^2}\operatorname{cosec}^3 t.$$

$$\bar{x} = a\cos t - \frac{(-b/a\cot t)}{(-b/a^2\operatorname{cosec}^3 t)}\left(1+\frac{b^2}{a^2}\cot^2 t\right)$$

$$\bar{x} = a\cos t - \frac{b}{a}\times\cot\times\frac{a^2}{b}\frac{1}{\operatorname{cosec}^3 t}\left(1+\frac{b^2}{a^2}\cot^2 t\right)$$

$$= a\cos t - \frac{b}{a}\frac{\cos t}{\sin t}\frac{a^2}{b}\sin^3 t\left(1+\frac{b^2}{a^2}\cot^2 t\right)$$

$$a\cos t - a\cos t\sin^2 t\left(1+\frac{b^2}{a^2}\cot^2 t\right)$$

$$a\cos t - a\cos t\sin^2 t - a\frac{b^2}{a^2}\cot^2 t\cos t\sin^2 t$$

$$a\cos t - a\cos t\sin^2 t - a\frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\cos t\sin^2 t$$

$$a\cos t - a\cos t\sin^2 t - \frac{b^2}{a}\cos^3 t.$$

$$a\cos t(1-\sin^2 t) - \frac{b^2}{a}\cos^3 t$$

$$a\cos^3 t - \frac{b^2}{a}\cos^3 t$$

$$\cos^3 t\left(a - \frac{b^2}{a}\right)$$

$$\cos^3 t\left(\frac{a^2-b^2}{a}\right)$$

$$\bar{y} = y + \frac{(1+y_1^2)}{y_2}$$

$$= b\sin t + \frac{(1 + b^2/a^2 \cot^2 t)}{(-b/a^2 \operatorname{cosec}^3 t)}$$

$$= b\sin t + \left(1 + \frac{b^2}{a^2}\cot^2 t\right)\left(\frac{-a^2}{b}\operatorname{cosec}^3 t\right)$$

$$= b\sin t + \left(1 + \frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\right)\left(\frac{-a^2}{b}\sin^3 t\right)$$

$$b\sin t + \left(1 + \frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t} \times \frac{-a^2}{b}\sin^3 t\right)$$

$$b\sin t + [1 + (-b^2 \cos^2 t \sin t)]$$

$$b\sin t + [1 - b\cos^2 t \sin t]$$

$$b\sin t + [1 - b(1-\sin^2 t)\sin t]$$

$$b\sin t (1 - \cos^2 t)$$

$$b$$

$$b\sin t + \left(\frac{-a^2}{b\sin^3 t}\right)\left(1 + \frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\right)$$

$$b\sin t + \left[\frac{-a^2 \sin^3 t}{b \cos^3 t}\right]\left[1 + \frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\right]$$

$$b\sin t + \left(\frac{-a^2}{b}\sin^3 t\right) \cdot -\frac{a^2 b^2}{b\, a^2}\frac{\cos^2 t}{\sin^2 t}$$

$$b\sin t \left(\frac{-a^2}{b}\sin^3 t\right)\left(-b\frac{\cos^2 t}{\sin^2 t}\right)$$

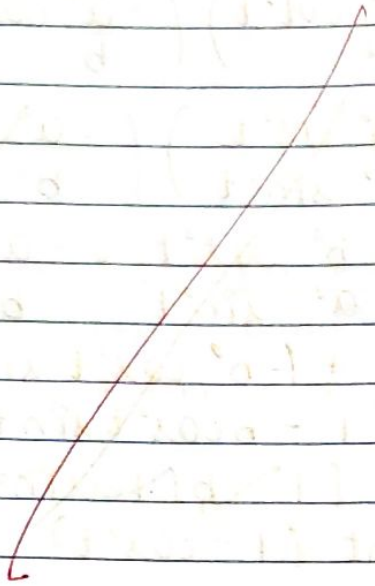
$$b\sin t (a^2 \sin t \cos^2 t)$$

$$b\sin t (a^2 \sin t [1 - \sin^2 t)]$$

$$b\sin t (a^2 \sin t - a^2 \sin^3 t)$$

$$= -\cos^3 t \left(\frac{a^2 - b^2}{a}\right)$$

03/02



(c) $\lim_{x \to \pi/2} (\sin x)^{\tan x}$

$K = \lim_{x \to \pi/2} (\sin \pi/2)^{\tan x} \quad \ldots 1^{\infty}$

$\log K = \lim_{x \to \pi/2} \log (\sin x)^{\tan x}$

$\log K = \lim_{x \to \pi/2} \tan x \log (\sin x)$

$\log K = \lim_{x \to \pi/2} \frac{\log (\sin x)}{\cot(x)}$

Apply L Hospital's rule,

$= \lim_{x \to \pi/2} \frac{\frac{1}{\sin x} \cos x}{-\operatorname{cosec}^2 x}$

$$\log K = \frac{\cos(\pi/2)}{\sin(\pi/2)} \Big/ -\operatorname{cosec}^2(\pi/2)$$

$$\log K =$$

(3b) continued,

$$\bar{y} = y + \frac{(1+y_1^2)}{y_2}$$

$$\bar{y} = b\sin t + \frac{(1 + b^2/a^2 \cot^2 t)}{(-b/a^2 \operatorname{cosec}^3 t)}$$

$$\bar{y} = b\sin t + \frac{\left(1 + \frac{b^2}{a^2}\cot^2 t\right)}{\left(-\frac{b}{a^2}\operatorname{cosec}^3 t\right)}$$

$$\bar{y} = b\sin t + \left(\frac{-a^2}{b}\sin^3 t\right)\left(1 + \frac{b^2}{a^2}\cot^2 t\right)$$

$$\bar{y} = b\sin t + \left(\frac{-a^2}{b}\sin^3 t\right)\left(1 + \frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\right)$$

$$\bar{y} = b\sin t + \left(\frac{-a^2}{b}\sin^3 t - \frac{a^2}{b}\frac{b^2}{a^2}\frac{\cos^2 t}{\sin^2 t}\sin^3 t\right)$$

$$= b\sin t + \left(\frac{-a^2}{b}\sin^3 t - b\cos^2 t \sin t\right)$$

$$b\sin t + (-a^2\sin^3 t - b^2\cos^2 t \sin t)$$

$$b\sin t - a^2\sin^3 t - b^2\cos^2 t \sin t$$

$$b\sin t - b^2(1-\sin^2 t)\sin t - a^2\sin^3 t$$

$$b\sin t - b^2\sin t + b^2\sin^3 t - a^2\sin^3 t$$

$$\sin^3 t\left(\frac{a^2 - b^2}{a}\right)$$

$$\bar{x} = \cos^3 t\left(\frac{a^2 - b^2}{a}\right)$$

Raise power by 2/3

$(\bar{x})^{2/3} = (\cos^2 t)\frac{(a^2-b^2)^{2/3}}{a^{2/3}}$

$(\bar{x}a)^{2/3} = (\cos^2 t)(a^2-b^2)^{2/3} \rightarrow (1)$

$\bar{y} = \sin^3 t\left(\frac{a^2-b^2}{a^2}\right)$

Raise power by 2/3

$(\bar{y})^{2/3} = \sin^2 t\frac{(a^2-b^2)^{2/3}}{a^{2/3}}$

$(\bar{y}a)^{2/3} = \sin^2 t\,(a^2-b^2)^{2/3} \rightarrow (2)$

Add (1) and (2)

$(\bar{x}a)^{2/3} + (\bar{y}a)^{2/3} = (\cos^2 t + \sin^2 t)[(a^2-b^2)^{2/3} + (a^2-b^2)^{2/3}]$

$(\bar{x}a)^{2/3} + (\bar{y}a)^{2/3} = (a^2-b^2)^{2/3}$

2) a) 03 3) a) 04

b) 05 b) 05

c) 04 c) 03

12 12

Q4

30

Ans=

II - IA.
Set - B.

Part - A.

2.

(a) $u = x + 3y^2 - z^3$

$v = 4x^2yz$

$w = 2x^2 - xy$

$\frac{\partial u}{\partial x} = (1)$ $\quad \frac{\partial v}{\partial x} = 8xyz$ $\quad \frac{\partial w}{\partial x} = 0 - 1 = -y$

$\frac{\partial u}{\partial y} = 6y$ $\quad \frac{\partial v}{\partial y} = 4x^2z$ $\quad \frac{\partial w}{\partial y} = -x$

$\frac{\partial u}{\partial z} = -3z^2$ $\quad \frac{\partial v}{\partial z} = 4x^2y$ $\quad \frac{\partial w}{\partial z} = 4z.$

$$\frac{\partial(u,v,w)}{\partial(x,y,z)} = \begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} & \frac{\partial u}{\partial z} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} & \frac{\partial v}{\partial z} \\ \frac{\partial w}{\partial x} & \frac{\partial w}{\partial y} & \frac{\partial w}{\partial z} \end{vmatrix}$$

05

$$= \begin{vmatrix} 1 & 6y & -3z^2 \\ 8xyz & 4x^2z & 4x^2y \\ -y & -x & 4z \end{vmatrix}$$

$= 1\{16x^2z^2 + 4x^3y\} - 6y\{32xyz^2 + 4x^2y^2\}$
$\quad - 3z^2\{-8x^2yz + 4x^2z\}.$

$= 1\{0 + (-4)\} - 6(-1)\{32(0) + (+4)\}$
$\quad - 3(0)\{0 + 0\}.$

$= 1\{-4\} + 6\{+4\} - 0 = 0.$

$-4+24$

$= 20.$

2(b) $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0.$

Let $\frac{dy}{dx} = p.$

$y(p)^2 + (x-y)p - x = 0.$

$p^2y + p(x-y) - x = 0.$

$$p = \frac{-b \pm \sqrt{b^2-4ac}}{2a}.$$

$a = y;\ b = (x-y)\ \ c = -x.$

$$p = \frac{-(x-y) \pm \sqrt{(x-y)^2 - 4(y)(-x)}}{2y}$$

$$= \frac{-(x-y) \pm \sqrt{x^2+y^2-2yx+4yx}}{2y}$$

$$= \frac{-(x-y) \pm \sqrt{x^2+y^2+2xy}}{2y}$$

$$= \frac{-(x-y) \pm \sqrt{(x+y)^2}}{2y}$$

$$= \frac{-(x-y) \pm (x+y)}{2y}.$$

$$p = \frac{-(x-y)+(x+y)}{2y} \qquad p = \frac{-(x-y)-(x+y)}{2y}$$

$$= \frac{-x+y+x+y}{2y} \qquad = \frac{-x+y-x-y}{2y}$$

$p = \frac{2y}{2y}$

$p = 1.$

$\int 1\,dx = c$

$x = c$

$p = \frac{-2x}{2y}$

$p = \frac{-x}{y}$

$\int \frac{-x}{y}\,dx = c.$

$-\frac{1}{y} \cdot \frac{x^2}{2} = c.$

03

$\therefore x \cdot \left(\frac{x^2}{2y}\right)$

2(c) $r^n = a^n \sin n\theta$

Apply log on both sides,

$\log(r^n) = \log(a^n \sin n\theta)$

$\log(r^n) = \log a^n + \log \sin n\theta.$

$n \log r = n \log a + \log \sin n\theta.$

Diff wrt θ

$n \frac{1}{r} \frac{dr}{d\theta} = 0 + \frac{1}{\sin n\theta} \cdot n(\cos n\theta)$

$\frac{1}{r} \frac{dr}{d\theta} = \cot n\theta.$

Replace $\frac{dr}{d\theta} \rightarrow -\frac{r^2\,d\theta}{dr}$

04

$-\frac{1}{r} \cdot r^2 \frac{d\theta}{dr} = \cot n\theta.$

$-r\frac{d\theta}{dr} = \cot n\theta.$

$-r\,d\theta = \cot n\theta\,dr.$

$\frac{d\theta}{\cot n\theta} = \frac{dr}{-r}$

$$\frac{d\theta}{\cot n\theta} + \frac{dr}{r} = 0$$

$$\frac{dr}{r} + \tan n\theta \, d\theta = 0.$$

$$\int \frac{dr}{r} + \int \tan n\theta \, d\theta = c$$

$$\log r + \frac{\log(\sec n\theta)}{n} = \log c.$$

$$n \log r + \log(\sec n\theta) = n \log c.$$

$$\log r^n + \log(\sec n\theta) = \log c^n.$$

$$\log(r^n \sec n\theta) = \log c^n.$$

$$\log(r^n \sec n\theta) - \log c^n = 0$$

$$\log\left(\frac{r^n \sec n\theta}{c^n}\right)$$

Part - B.

4(b) $(px - y)(py + x) = 2p.$

$X = x^2.$ $\qquad Y = y^2$

$\frac{dX}{dx} = 2x.$ $\qquad \frac{dY}{dy} = 2y$

$$p = \frac{dy}{dx} = \frac{dy}{dY} \frac{dY}{dX} \frac{dX}{dx}$$

$$= \frac{1}{2y} P \cdot 2x$$

$$= \frac{Px}{y}$$

Substitute this in main eqn.

$\left(\frac{px}{y} - y\right)\left(\frac{px.y + x}{y}\right) = \frac{2px}{y}$.

$y = \sqrt{y}$.
$x = \sqrt{x}$.

$\left(\frac{px}{\sqrt{y}} - \sqrt{y}\right)\left(\frac{px.y + \sqrt{x}}{y}\right) = \frac{2px}{y}$.

02 $\left(\frac{px - y}{\sqrt{y}}\right)\left(\frac{px + \sqrt{xy}}{y}\right) = \frac{2px}{y}$.

4(c) $r^n \cos n\theta = a^n$

$a^n = r^n \cos n\theta$.

Apply log on both sides,

$\log a^n = \log (r^n \cos n\theta)$

$\log a^n = \log r^n + \log \cos n\theta$.

$n \log a = n \log r + \log \cos n\theta$.

Diff wrt 'θ':

$0 = n \frac{1}{r}\frac{dr}{d\theta} + \frac{1}{\cos n\theta} \cdot n(-\sin n\theta)$.

$-n \frac{1}{r}\frac{dr}{d\theta} = -n \frac{\sin n\theta}{\cos n\theta}$

04 * Replace $\frac{dr}{d\theta} \to -r^2 \frac{d\theta}{dr}$.

$\frac{-1}{r} \cdot r^2 \frac{d\theta}{dr} = \tan n\theta$.

$-r \frac{d\theta}{dr} = \tan n\theta$.

$\frac{d\theta}{\tan\theta} = \frac{dr}{-r}$.

$\frac{d\theta}{\tan n\theta} + \frac{dr}{r} = 0$.

$$\cot n\theta\, d\theta + \frac{dr}{r} = c.$$

$$\int \cot n\theta\, d\theta + \int \frac{dr}{r} = c.$$

$$\int \frac{dr}{r} + \int \cot n\theta\, d\theta = c.$$

$$\log r + \log\left(\frac{\sin n\theta}{n}\right) = \log c.$$

$$n\log r + \log(\sin n\theta) = n\log c.$$

$$\log r^n + \log(\sin n\theta) = \log c^n.$$

$$\log\{r^n \sin n\theta\} = \log c^n.$$

$$\log r^n \sin n\theta = \log c^n$$

$$\log\left(\frac{r^n \sin n\theta}{c^n}\right) = 0.$$

Extra Questions.

Part - B.

3(b)

$t_1 = 100^\circ C$

$T = 75^\circ C$

$t_2 = 25^\circ C$

$t = 1 \text{ min}$

$T = t_2 + (t_1 - t_2)e^{-kt}$

$75^\circ = 25 + (100 - 25)e^{-k(1)}$

$75 - 25 = 75e^{-k}$

$50 = 75e^{-k}$

$\frac{50}{75} = e^{-k}$

$\frac{75}{50} = e^{K}$.

$\log\left(\frac{75}{50}\right) = \log e^{K}$

$0.4054 = K$.

At $t = t = 3$ min,

$T = t_2 + (t_1 - t_2)e^{-Kt}$

$75 = 25 + 75e^{-(0.4054)3}$

$50 = 75e^{-1.2162}$

$\frac{50}{75} = e^{-1.2162}$

$\frac{75}{50} = e^{1.2162}$

$\log\left(\frac{75}{50}\right) = \log\left(e^{1.2162}\right)$

$0.4054 = 1.2162$.

$25 = t_2 + 75e^{-1.2162}$

03

3(c) $(y^3 - 3x^2y)dx - (x^3 - 3xy^2)dy = 0$

$M = y^3 - 3x^2y$. $\quad N = -x^3 + 3xy^2$

$\frac{\partial M}{\partial y} = 3y^2 - 3x^2$ $\quad \frac{\partial N}{\partial x} = -3x^2 + 3y^2$.

05

$\therefore \frac{\partial M}{\partial y} = \frac{\partial N}{\partial x} = 3y^2 - 3x^2$.

$\therefore$ The equations are exact.

The solution is,

$\int M dx + \int N(y) dy = 0$.

$$\int (y^3 - 3x^2y)\,dx + \int 0\,dy = 0.$$

$$xy^3 - 3y\frac{x^3}{3} = c.$$

$$xy^3 - x^3y = c$$

20/30

MB

~~III~~ - IA

SET - B.

PART - A.

1.

(a) $A = \begin{bmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$

$R_1 \leftrightarrow R_2$

$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 4 & 8 & 13 & 12 \end{bmatrix}$

$R_3 \rightarrow R_3 - 2R_1$

$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 0 & 2 & 3 & 4 \end{bmatrix}$

$R_3 \rightarrow R_3 - R_2$

$A = \begin{bmatrix} 2 & 3 & 5 & 4 \\ 0 & 2 & 3 & 4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

05

$\therefore \rho(A) = 2.$

$\therefore$ Rank of given matrix is 2.

1. (b)

$2x + 5y + 7z = 52$

$2x + y - z = 0$

$x + y + z = 9.$

$[A : B] = \begin{bmatrix} 2 & 5 & 7 & : & 52 \\ 2 & 1 & -1 & : & 0 \\ 1 & 1 & 1 & : & 9 \end{bmatrix}$ is augmented matrix

$R_2 \to R_2 - R_1 \qquad R_3 \to 2R_3 - R_1$

$$[A : B] \sim \left[\begin{array}{ccc:c} 2 & 5 & 7 & 52 \\ 0 & -4 & -8 & -52 \\ 0 & -3 & -5 & -34 \end{array}\right]$$

$R_3 \to 4R_3 - 3R_2$

$$\left[\begin{array}{ccc:c} 2 & 5 & 7 & 52 \\ 0 & -4 & -8 & -52 \\ 0 & 0 & 4 & 20 \end{array}\right]$$

$2x + 5y + 7z = 52.$

$-4y - 8z = -52$

$4z = 20$

$\Rightarrow z = 5.$

$\therefore -4y - 8(5) = -52$

$-4y = 40 - 52$

$y = \frac{-12}{-4}$

$= 3.$

05 $2x + 5(3) + 7(5) = 52$

$2x + 15 + 35 = 52$

$2x + 50 = 52$

$2x = 2$

$x = 1.$

$\therefore x = 1, y = 3$ and $z = 5.$

Verify.

$2x + 5y + 7z = 52$

$2(1) + 5(3) + 7(5)$

$52 = 52.$

1. (c) $B(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.

$$B(m,n) = 2\int_0^{\pi/2} \sin^{2m-1}\theta \cos^{2n-1}\theta \, d\theta$$

$$\Gamma(n) = 2\int_0^{\infty} e^{-x^2} x^{2n-1} dx$$

$$\Gamma(m) = 2\int_0^{\infty} e^{-y^2} y^{2m-1} dy.$$

θ varies 0 to $\pi/2$
r varies 0 to ∞

$$\Gamma(m+n) = 2\int_0^{\infty} e^{-r^2} r^{2(m+n)-1} dr$$

$$\Gamma(m)\Gamma(n) = 2\left(2\int_0^{\infty} e^{-x^2} x^{2m-1} dx\right)\left(2\int_0^{\infty} e^{-y^2} y^{2n-1} dy\right)$$

$$= 4\int_0^{\infty}\int_0^{\infty} e^{-(x^2+y^2)} x^{2m-1} y^{2n-1} dx\, dy.$$

$x = r\cos\theta \quad y = r\sin\theta \Rightarrow x^2 + y^2 = r^2.$

$dx\, dy = r\, dr\, d\theta$

θ varies from 0 to $\pi/2$

r varies from 0 to ∞.

$$\Gamma(m)\Gamma(n) = 4\int_0^{\pi/2}\int_0^{\infty} e^{-r^2} (r\cos\theta)^{2m-1} dx\, (r\sin\theta)^{2n-1} dy$$

$$\Gamma(m)\Gamma(n) = 4\int_0^{\pi/2}\int_0^{\infty} e^{-r^2} (r\cos\theta)^{2m-1} (r\sin\theta)^{2n-1} r\, dr\, d\theta.$$

$$2\int_0^{\infty} e^{-r^2}$$

$$4\int_0^{\pi/2}\int_0^{\infty} e^{-r^2} r^{2m-1}\cos^{2m-1}\theta\; r^{2n-1}\sin^{2n-1}\theta\, r\,dr\,d\theta.$$

$$2\left(2\int_0^{\infty} e^{-r^2} r^{2m-1} r^{2n-1} r\,dr\right)\left(2\int_0^{\pi/2}\sin^{2n-1}\theta\cos^{2m-1}\theta\,d\theta\right.$$

$$2\left(2\int_0^{\infty} e^{-r^2} r^{2m+2n-1+1}\,dr\right)\left(2\int_0^{\pi/2}\sin^{2n-1}\theta\cos^{2m-1}\theta\,d\theta\right.$$

$$\left(2\int_0^{\infty} e^{-r^2} r^{2(m+n)-1}\,dr\right)\left(2\int_0^{\pi/2}\sin^{2n-1}\theta\cos^{2m-1}\theta\,d\theta\right)$$

$\therefore \Gamma(m)\Gamma(n) = \Gamma(m+n)\,\beta(m,n)$

$\therefore \beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$

Hence proved

Part - B.

3 (b) ~~$3x + 2y + z = 14$~~

$5x + y + 3z = 20$

$2x + 5y + 2z = 18$

$3x + 2y + z = 14$

$[A : B] = \left[\begin{array}{ccc|c} 5 & 1 & 3 & 20 \\ 2 & 5 & 2 & 18 \\ 3 & 2 & 1 & 14 \end{array}\right]$ is the augmented matrix.

$R_2 \to 5R_2 - 2R_1 \qquad R_3 \to 5R_3 - 3R_1$

$$\left[\begin{array}{ccc|c} 5 & 1 & 3 & 20 \\ 0 & 23 & 4 & 50 \\ 0 & 7 & -4 & 10 \end{array}\right]$$

$$\left[\begin{array}{ccc|c} 2 & 5 & 2 & 18 \\ 5 & 1 & 3 & 20 \\ 3 & 2 & 1 & 14 \end{array}\right]$$

$R_2 \to 2R_2 - 5R_1 \qquad R_3 \to 2R_3 - 3R_1$

$$\left[\begin{array}{ccc|c} 2 & 5 & 2 & 18 \\ 0 & -23 & -4 & -50 \\ 0 & -11 & -4 & -26 \end{array}\right]$$

3°

(c) $\int_0^\infty \sqrt{y}\, e^{-y^2}\, dy \times \int_0^\infty \frac{e^{-y^2}}{\sqrt{y}}\, dy$

$I_1 = \int_0^\infty \sqrt{y}\, e^{-y^2}\, dy \to (1)$

$= \int_0^\infty e^{-y^2}\, y^{1/2}\, dy$

$I_2 = \int_0^\infty e^{-y^2}\, y^{-1/2}\, dy \to (2)$

$$\Gamma(n) = 2\int_0^\infty e^{-x^2} x^{2n-1}\, dx. \rightarrow (3)$$

$$\frac{\Gamma(n)}{2.} = \int_0^\infty e^{-x^2} x^{2n-1}\, dx$$

Compare (1) and (3).

$$2n-1 = \frac{1}{2}$$

$$2n = \frac{3}{2}$$

$$n = \frac{3}{4}.$$

$$\therefore I_1 = \frac{\Gamma(n)}{2} = \frac{\Gamma(3/4)}{2.}$$

Compare (2) and (3).

$$2n-1 = \frac{-1}{2}$$

$$2n = \frac{1}{2}$$

$$n = \frac{1}{4}$$

$$\therefore I_2 = \frac{\Gamma(n)}{2} = \frac{\Gamma(1/4)}{2.}$$

$$I_1 \times I_2 = \frac{\Gamma(3/4)}{2} \times \frac{\Gamma(1/4)}{2}$$

$$= \frac{1}{4}\Gamma(3/4)\cdot\Gamma(1/4)$$

05

$$= \frac{1}{4}\pi\sqrt{2}$$

$$= \frac{1}{2\times 2}\pi\sqrt{2}$$

$$= \frac{1}{\sqrt{2}\times\sqrt{2}\times\sqrt{2}\times\sqrt{2}}\pi\sqrt{2} = \frac{\pi}{2\sqrt{2}}.$$ Hence proved.

3.

(a) $20x + y - 2z = 17$

$3x + 20y - z = -18$

$2x - 3y + 20z = 25.$

$$x = \frac{1}{20}[17 - y + 2z]$$

$$y = \frac{1}{20}[-18 - 3x + z]$$

$$z = \frac{1}{20}[25 - 2x + 3y]$$

Let the initial approximations be $x^{(0)} = 0$, $y^{(0)} = 0$ $z^{(0)} = 0$.

I approx.

$$x^{(1)} = \frac{1}{20}[17 - y^{(0)} + 2z^{(0)}]$$

$$= \frac{1}{20}[17 - 0 + 2(0)] = \frac{17}{20} = 0.85.$$

$$y^{(1)} = \frac{1}{20}[-18 - 3x^{(1)} + z^{(0)}]$$

$$= \frac{1}{20}[-18 - 3(0.85) + 0]$$

$$\frac{1}{20}[-20.55] = 1.0275.$$

$$z^{(1)} = \frac{1}{20}[25 - 2x^{(1)} + 3(y^{(1)}]$$

$$= \frac{1}{20}[25 - 2(0.85) + 3(1.0275)] = \frac{1}{20}[25 - 1.7 + 3.0825]$$

$$= \frac{1}{20}[26.3825] = 1.319125.$$

II approx,

$$x^{(2)} = \frac{1}{20}[17 - y^{(1)} + 2z^{(1)}]$$

$$= \frac{1}{20}[17 - 1.0275 + 2(1.319125)]$$

$$= \frac{1}{20}[17 - 1.0275 + 2.63825]$$

$$= \frac{1}{20}[\quad = 0.9305375.$$

$$y^{(2)} = \frac{1}{20}[-18 - 3x^{(2)} + z^{(1)}]$$

$$= \frac{1}{20}[-18 - 3(0.9305375) + 1.319125]$$

$$= \frac{1}{20}[-18 - 2.7916125 + 1.319125]$$

$$= -0.973624.$$

$$z^{(2)} = \frac{1}{20}[25 - 2x^{(2)} + 3y^{(2)}]$$

$$= \frac{1}{20}[25 - 2(0.93053) + 3(-0.97362)]$$

$$= \frac{1}{20}[25 - 1.86106 - 2.92086]$$

$$= 1.010904.$$

III approx,

$$x^{(3)} = \frac{1}{20}\left[17 - y^{(2)} + 2z^{(2)}\right]$$

$$= \frac{1}{20}\left[17 - (-0.973624) + 2(1.010904)\right]$$

$$= \frac{1}{20}\left[17 + 0.973624 + 2.021808\right]$$

$$= 0.9997716$$

$$y^{(3)} = \frac{1}{20}\left[18 - 3x^{(3)} + z^{(2)}\right]$$

$$= \frac{1}{20}\left[18 - 3(0.9997716) + 1.010904\right]$$

$$= \frac{1}{20}\left[18 - 2.9993148 + 1.010904\right]$$

$$= 0.800579.$$

$$z^{(3)} = \frac{1}{20}\left[25 - 2x^{(3)} + 3y^{(3)}\right]$$

$$= \frac{1}{20}\left[25 - 2(0.9997716) + 3(0.800579)\right]$$

$$= \frac{1}{20}\left[25 - 1.9995432 + 2.401737\right)$$

$$= 1.27010.$$

IV approx,

$$x^{(4)} = \frac{1}{20}\left[17 - y^{(3)} + 2z^{(3)}\right]$$

$$= \frac{1}{20}\left[17 - 0.800579 + 2(1.27010)\right] = 0.93698.$$

$$y^{(4)} = \frac{1}{20}\left[-18 - 3x^{(3)} + z^{(3)}\right]$$

$$= \frac{1}{20}\left[-18 - 3(0.9997716) + 1.27010\right]$$

$$= \frac{1}{20}\left[-18 - 2.99931 + 1.27010\right]$$

$$= -0.986.$$

$$x^{(4)} = \frac{1}{20}\left[25 - 2x^{(4)} + 3y^{(4)}\right]$$

$$= \frac{1}{20}\left[25 - 2(0.93698) + 3(-0.986)\right]$$

04

$$= 1.008402.$$

3 (b)

$$5x + y + 3z = 20$$
$$2x + 5y + 2z = 18$$
$$3x + 2y + z = 14.$$

5	1	3	: 20
2	5	2	: 18
3	2	1	: 14

$R_2 \rightarrow 5R_2 - 2R_1$ $\quad R_3 \rightarrow 5R_3 - 3R_1$

5	1	3	: 20
0	23	4	: 50
0	7	-4	: 10.

$R_1 \leftrightarrow R_3$

3	2	1	: 14
2	5	2	: 18
5	1	3	: 20

$R_3 - 3R_3 - 5R_1$

$R_2 \rightarrow 3R_2 - 2R_1$

3	2	1	: 14
0	11	3	:
0	-7		:

$$\left[\begin{array}{ccc:c} 3 & 2 & 1 & 14 \\ 2 & 5 & 2 & 18 \\ 5 & 1 & 3 & 20 \end{array}\right]$$

$R_2 \to 3R_2 - 2R_1$ $\quad$ $R_3 \to 3R_3 - 5R_1$

$$\left[\begin{array}{ccc:c} 3 & 2 & 1 & 14 \\ 0 & 11 & 4 & 26. \\ 0 & -7 & 4 & -10 \end{array}\right]$$

$R_3 \to 11R_3 + 7R_2.$

$$\left[\begin{array}{ccc:c} 3 & 2 & 1 & 14 \\ 0 & 11 & 4 & 26 \\ 0 & 0 & 72 & 72. \end{array}\right]$$

$\rho(A) = 3.$

$\rho(A:B) = 3.$

$\therefore$ The system is consistent

$\rho = 3$ and $n = 3$

$\rho = n = 3.$

The system has unique solution.

$3x + 2y + z = 14$

$11y + 4z = 26$

$72z = 72$

$\Rightarrow z = 1$

$11y + 4(1) = 26$

$11y = 22$

$y = 2.$

$3x + 2(2) + 1 = 14$

$3x + 4 + 1 = 14$

$x = 3$

$\therefore x = 3$ and $y = 2$ and $z = 1$

Verify :-

$5x + y + 3z = 20$

$5(3) + 2 + 3(1)$

$15 + 2 + 3$

$20 = 20$

A37

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BLUE BOOK

Name of the Student: Gautham Narkodu

Class / Sem : 'A' section / 1st sem **Branch:** CSE

USN : 1 K G 2 0 C S 0 3 9

SUBJECT : Engineering Physics **Subject Code :** 18PHY12

MAXIMUM MARKS : 40

Test	I	II	III	Average Marks Obtained
Date	28-01-21	26-02-21	25-3-21	30+10
Marks Obtained	30	30	29	40/40
Signature of the Student	Gautham	Gautham	Gautham	
Initials of Room Supervisor	28/1/2021			
Initials of Faculty				7/4/2021

NAME OF FACULTY : KUSUMA · M

SIGNATURE :

C Vasudev

SIGNATURE OF H.O.D.

K S SCHOOL OF ENGINEERING AND MANAGEMENT

First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	1	3(a)	5	1	1	20
1(b)	5	1	3(b)	5	1		
1(c)	5	2	3(c)	5	2	2	10
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	30

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	2	3(a)			2	10
1(b)	5	3	3(b)				
1(c)	5	3	3(c)			3	20
OR			OR				
2(a)			4(a)	5	2		
2(b)			4(b)	5	3		
2(c)			4(c)	5	3	**Grand Total**	30

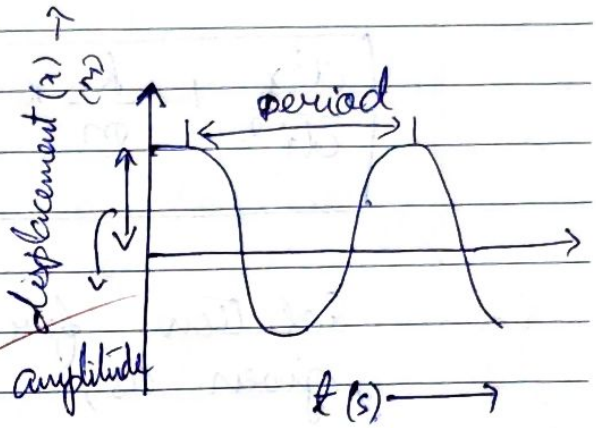
Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	5	4	4	20
1(b)			3(b)	5	4		
1(c)			3(c)	5	5	5	9
OR			OR				
2(a)	5	4	4(a)				
2(b)	5	4	4(b)				
2(c)	4	5	4(c)			**Grand Total**	29

Signature of the Staff

PART - A

1) a) Simple harmonic motion is a motion in which a body vibrates periodically and acts on along line of propagation from mean position, the acceleration of the body is directly proportional to displacement and is towards equilibrium.



Consider a particle of mass 'm' undergoing Simple harmonic motion.

For the body executing Simple harmonic motion, a restoring force is acting on its

Equation of restoring force is given by

$$F = -kx \quad -①$$

$k \rightarrow$ force constant

$x \rightarrow$ displacement

From Newton's law we have

$$F = ma$$

$$F = m\frac{d^2x}{dt^2} \quad -②$$

Comparing eqn ① & ② we get,

$$m\frac{d^2x}{dt^2} = -kx$$

$$m\frac{d^2x}{dt^2} + kx = 0$$

∴ m on both sides

$$\boxed{\frac{d^2x}{dt^2} + \frac{k}{m}x = 0} \rightarrow \text{differential equation of motion for SHM.} \quad -③$$

Solution for above equation is given as,

$$x = A\sin\omega t \quad -④$$

differentiate eqn ④ twice w.r.t t

$$\frac{dx}{dt} = \omega A\cos\omega t$$

$$\frac{d^2x}{dt^2} = -\omega^2 A\sin\omega t \quad -⑤ \qquad \frac{d^2x}{dt^2} + \omega^2 x = 0 \quad -⑤$$

Comparing eqn ⑤ & ③

$$\omega^2 = \frac{k}{m} \qquad \omega = \sqrt{\frac{k}{m}}$$

1) b) Shock waves are propagating disturbance which moves with velocity greater than the speed of sound.
Shock waves are characterised by abrupt and discontinuous change in pressure, temperature and density.

- Shock waves travel in the medium with Mach number greater than 1.
- The effect of shockwaves causes in the increase of entropy.
- Shock waves are confined to very thin space of thickness of 1 μm. At that instant in that space there is change in temperature, pressure and density at large scales.
- Shock waves are not conventional waves hence its difficult to ~~analyze~~ to associate with sound waves. But shock waves have properties which are similar to sound waves.

1) c) uncertainity → 0.003%

The speed of electron $v = 800$ m/s

$\Delta x = ?$

$$\Delta V = \frac{800 \times 0.003}{100}$$

$\Delta v = 0.024\ ms^{-1}$

$P = mv$

$P = 9.1 \times 10^{-31} \times 0.024$

$P = 2.184 \times 10^{-32}\ kg\ ms^{-1}$

$\Delta P \cdot \Delta x \geq \frac{h}{4\pi}$

$\Delta x \geq \frac{h}{4\pi \Delta P}$

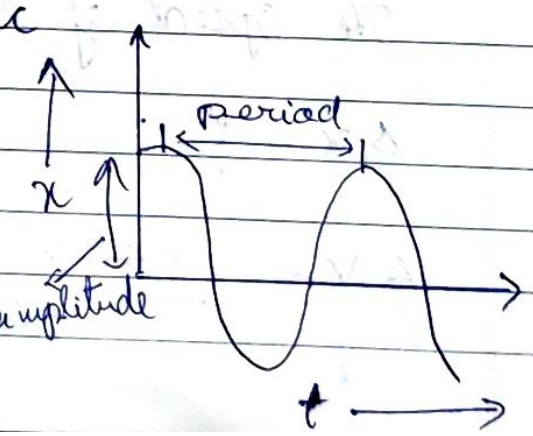
$\Delta x \geq \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 2.184 \times 10^{-32}}$

$\Delta x \geq 2.41 \times 10^{-3}\ m$

PART - B

3) a) Consider a particle of mass 'm' performing simple harmonic motion.

For the body in SHM restoring force and resistive force gets acted on it.



Restoring force is $F = -kx$
resistive force is $F = r\frac{dx}{dt}$

The equation for the ~~body~~ SHM of body with these forced acting on it is given by

$$m\frac{d^2x}{dt^2} = -kx - r\frac{dx}{dt}$$

$$m\frac{d^2x}{dt^2} + kx + r\frac{dx}{dt} = 0$$

% m on both sides

$$\frac{d^2x}{dt^2} + \frac{k}{m}x + \frac{r}{m}\frac{dx}{dt} = 0$$

$$\frac{d^2x}{dt^2} + \omega^2 x + 2b\frac{dx}{dt} = 0 \quad \text{—(1)}$$ This second order differential equation of SHM

Here $\omega^2 = \frac{k}{m}$, $2b = \frac{r}{m}$

$k \rightarrow$ force constant.
$b \rightarrow$ damping constant
$\omega \rightarrow$ angular frequency

The solution for equation (1) is given as $x = Ae^{\alpha t}$ —(2)

Differentiate the above equation twice w.r.t 't'

$$\frac{dx}{dt} = Ae^{\alpha t} \times \alpha \quad -③$$

$$\frac{d^2x}{dt^2} = Ae^{\alpha t} \times \alpha^2 \quad -④$$

Substitute equations ②, ③ & ④ in equation ①

$$\alpha^2 Ae^{\alpha t} + \omega^2 Ae^{\alpha t} + 2b\, Ae^{\alpha t} \alpha = 0$$

$$Ae^{\alpha t}\left(\alpha^2 + 2b\alpha + \omega^2\right) = 0$$

$$\alpha^2 + 2\alpha b + \omega^2 = 0 \quad -⑤ \quad \because Ae^{\alpha t} \neq 0$$

the solution for above equation can be written by using

$$x = \frac{b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\alpha = \frac{2b \pm \sqrt{4b^2 - 4\omega^2}}{2a}$$

$$\alpha = \frac{2b \pm 2\sqrt{b^2-\omega^2}}{2(1)}$$

$$\alpha = b \pm \sqrt{b^2-\omega^2} \quad -(6)$$

Substitute eqn (6) in eqn (2)

$$\therefore \boxed{x = A_1 e^{(b+\sqrt{b^2-\omega^2})t} + A_2 e^{(b-\sqrt{b^2-\omega^2})t}}$$

3)b) $m = 0.5\ kg$ $\quad k = ?$ $\quad T = ?$

$x = 0.03\ m$ $\quad \omega = ?$

We know,

$$F = kx \quad \text{and} \quad F = mg$$

$$mg = kx$$

$$k = \frac{mg}{x}$$

$$k = \frac{0.5 \times 9.8}{0.03}$$

$$k = 163.33\ Nm^{-1}$$

$$\omega^2 = \frac{k}{m}$$

$$\omega^2 = \frac{163.33}{0.5}$$

$$\omega^2 = 326.66$$

$$\omega = \sqrt{326.66}$$

$$\omega = 18.07 \text{ rads}^{-1}$$

$$\omega = \frac{2\pi}{T}$$

$$T = \frac{2\pi}{\omega}$$

$$T = \frac{2 \times 3.14}{18.07} = 0.34 \text{ s}$$

3) c) Consider the wave function equation,

$$\psi = Ae^{(i\omega t - kx)} \quad -①$$

Choosing only the time independent part of the above equation,

$$\psi = A e^{(-kx)} \quad -(2)$$

Substituting (2) in (1)

$$\psi = \psi A e^{i\omega t} \quad -(3)$$

differentiate the equation (3) w.r.t 'x' twice

$$\frac{d\psi}{dx} = A e^{i\omega t} \frac{d\psi}{dx}$$

$$\frac{d^2\psi}{dx^2} = A e^{i\omega t} \frac{d^2\psi}{dx^2} \quad -(4)$$

differentiate equation (3) w.r.t 't' twice

$$\frac{d\psi}{dt} = \psi A e^{i\omega t} \times i\omega$$

$$\frac{d^2\psi}{dt^2} = \psi A e^{i\omega t} \times (i\omega)^2$$

$$\frac{d^2\psi}{dt^2} = -\psi A e^{i\omega t} (\omega^2) \quad -(5)$$

The equation for travelling wave can be written as

$$\frac{d^2y}{dx^2} = \frac{1}{v^2}\frac{d^2y}{dt^2}$$

But for matter waves, equation is given as,

$$\frac{d^2\psi}{dx^2} = \frac{1}{v^2}\frac{d^2\psi}{dt^2} \quad -(6)$$

Substitute equations (4) & (5) in equation (6)

$$Ae^{i\omega t}\frac{d^2\psi}{dx^2} = \frac{1}{v^2} \times \left(-\psi Ae^{i\omega t}\omega^2\right)$$

$$\frac{d^2\psi}{dx^2} = -\frac{\omega^2\psi}{v^2}$$

$$\frac{d^2\psi}{dx^2} = -\frac{(2\pi\nu)^2\psi}{(\nu\lambda)^2}$$

$$\frac{d^2\psi}{dx^2} = -\frac{4\pi^2\psi}{\lambda^2}$$

$$\frac{1}{\lambda^2} = -\frac{d^2\psi}{dx^2} \times \frac{1}{4\pi^2} \times \frac{1}{\psi} \quad -(7)$$

Kinetic energy equation is given by

$$E_k = \frac{1}{2}mv^2$$

multiply & divide by m

$$E_k = \frac{1}{2} \frac{m^2 v^2}{m}$$

$$E_k = \frac{p^2}{2m} \quad -(8)$$

From De Broglie's wavelength

$$\lambda = \frac{h}{p}$$

$$p = \frac{h}{\lambda}$$

$$p^2 = \frac{h^2}{\lambda^2} \quad -(9)$$

Substitute Equation (9) in (8)

$$E_k = \frac{h^2}{2m\lambda^2}$$

$$E_k = \frac{h^2}{2m} \times \left(- \frac{d^2\psi}{dx^2} \times \frac{1}{4\pi^2} \times \frac{1}{\psi} \right)$$

$$E_k = - \frac{h^2}{2m} \times \frac{d^2\psi}{dx^2} \times \frac{1}{4\pi^2\psi}$$

The total energy equation is given by

$$E = E_k + V$$

$$E - V = E_k$$

$$-\frac{d^2\psi}{dx^2} \times \frac{h^2}{8\pi^2 m} \times \frac{1}{\psi} = (E - V)$$

$$\boxed{\frac{d^2\psi}{dx^2} = -\left[(E - V)\frac{8\pi^2 \psi m}{h^2}\right]}$$

This equation is one dimensional time independent Schrodinger wave equation.

30/30

8/2/2021

PART-A

1) a) Consider a system to be at thermal equilibrium. There won't be any change in the energy of system if any changes takes place internally.

∴ The rate of induced absorption = rate of spontaneous emission + rate of stimulated emission.

$$\frac{dN_{12}}{dt} = \frac{dN_{21}}{dt} + \frac{dN_{21}}{dt}$$

Induced absorption — Spontaneous emission — stimulated emission

$$B_{12} N_1 E_\nu = A_{21} N_2 + B_{21} N_2 E_\nu \quad -(1)$$

B_{12} → Einstein's coefficient for induced absorption

B_{21} → Einstein's coefficient for stimulated emission

A_{21} → Einstein's coefficient for spontaneous emission

N_1 → number of atoms in lower energy state

N_2 → number of atoms in higher energy state

E_ν → energy density of photons

$$B_{12} N_1 E_\nu - B_{21} N_2 E_\nu = A_{21} N_2$$

$$E_\nu (B_{12} N_1 - B_{21} N_2) = A_{21} N_2$$

$$E_\nu = \frac{A_{21} N_2}{B_{12} N_1 - B_{21} N_2}$$

$$E_\nu = \frac{A_{21} N_2}{B_{21} N_2 \left(\frac{B_{12}}{B_{21}} \times \frac{N_1}{N_2} - 1 \right)} \quad -(2)$$

From Boltzman's law,

$$N = e^{\frac{-E}{KT}}$$

$$\frac{N_1}{N_2} = \frac{e^{\frac{-E_1}{KT}}}{e^{\frac{-E_2}{KT}}}$$

$$\frac{N_1}{N_2} = e^{\frac{E_2 - E_1}{KT}}$$

$$\Delta E = E_2 - E_1$$

$$h\nu = E_2 - E_1$$

$$\frac{N_1}{N_2} = e^{\frac{h\nu}{KT}} \quad -(3)$$

Substitute eqn (3) in eqn (1)

$$E_\nu = \frac{A_{21}}{B_{21}} \times \frac{1}{\frac{B_{12}}{B_{21}} \times e^{h\nu/KT} - 1} \quad -(4)$$

From planck's law,

$$E_\nu = \frac{8\pi h\nu^3}{c^3}\left(\frac{1}{e^{h\nu/KT}-1}\right) \quad -(5)$$

Comparing (4) & (5) we get,

$$\boxed{\frac{A_{21}}{B_{21}} = \frac{8\pi h\nu^3}{c^3}} \quad -(6) \qquad \frac{B_{12}}{B_{21}} = 1 \Rightarrow \boxed{B_{12} = B_{21}} \quad -(7)$$

Equation (6) & (7) are Einstein's coefficients

Eqn (4) $\Rightarrow$

$$E_\nu = \frac{A_{21}}{B_{21}} \times \frac{1}{e^{h\nu/KT}-1} \quad -(8)$$

Since the body is in thermal equilibrium

$A_{21} = A$ & $B_{21} = B$

Eqn (8) ⇒ 6

$$E_\gamma = \frac{A}{B} \times \frac{1}{e^{h\nu/KT} - 1} \quad -(9)$$

Equation (9) is the expression for energy density of radiation in terms of Einstein coefficients.

1)b)

Fermi factor is given by,

$$f(E) = \frac{1}{e^{\frac{E-E_F}{KT}} + 1}$$

Case 1: $E < E_F$ at $T = 0K$

$$f(E) = \frac{1}{e^{\frac{-E_F}{K(0)}} + 1}$$

$$f(E) = \frac{1}{e^{-\infty} + 1}$$

$$f(E) = \frac{1}{\infty + 1}$$

$$f(E) = \frac{1}{1}$$

$$f(E) = 1$$

∴ All the energy states below fermi level are occupied by electrons.

Case 2 : $E > E_f$ at $T = 0K$

$$f(E) = \frac{1}{e^{\frac{E}{K(0)}} + 1}$$

$$f(E) = \frac{1}{e^{\infty} + 1}$$

$$f(E) = \frac{1}{\infty}$$

$$f(E) = 0$$

∴ All the energy levels above fermi level are unoccupied by electrons.

Case 3: $E = E_F$ at $T > 0K$

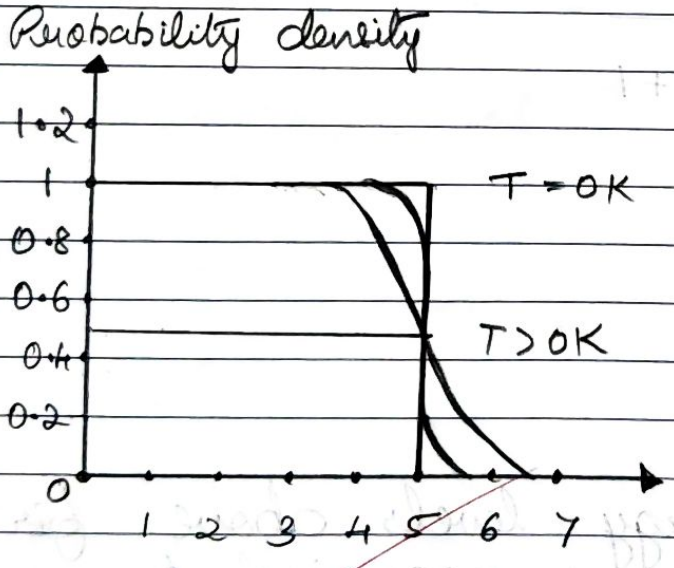
$$f(E) = \frac{1}{e^{\frac{0}{KT}} + 1}$$

$$f(E) = \frac{1}{1+1}$$

$$f(E) = \frac{1}{2}$$

$$f(E) = 0.5$$

∴ At ordinary temperature probable value starts decreasing from 1 as value E comes closer to E_F



1) c) Consider a semiconductor of crossectional area (A). Let 'V_d' be the drift velocity of electrons flowing which contributes to electricity.

The current density is given by,

$$J = \frac{I}{A} \quad -(1)$$

We know,

$$I = N_e e A V_d \quad -(2)$$

Substitute (2) in (1)

$$J = \frac{N_e e A V_d}{A}$$

$$J = N_e e V_d \quad -(3)$$

Mobility of electrons is given by

$$\mu_e = \frac{V_d}{E} \quad -(4)$$

$$V_d = \mu_e E \quad -(4)$$

Substitute (4) in (3)

$$J = N_e e \mu_e E \quad -(5)$$

From Ohm's law,

$$J = \sigma E$$

for electrons,

$$J = \sigma_e E \quad -(6)$$

Substitute (6) in (5)

$$\sigma_e E = N_e e \mu_e E$$

$$\sigma_e = N_e e \mu_e \quad -(7)$$

Eqn (7) is electric conductivity for electrons

electric conductivity for holes is given by

$$\sigma_h = N_h e \mu_h \quad -(8)$$

The total electrical conductivity is

$$\sigma = \sigma_e + \sigma_h$$

$$\sigma = N_e e \mu_e + N_h e \mu_h$$

$$\sigma = e\left(N_e \mu_e + N_h \mu_h\right) \quad -(9)$$

Eqn (9) is expression for electrical conductivity of extrinsic semi conductor.

for intrinsic semiconductor,

$$N_e = N_h = n_i$$

(9) $\Rightarrow$

$$\sigma = e\left(n_i \mu_e + n_i \mu_h\right)$$

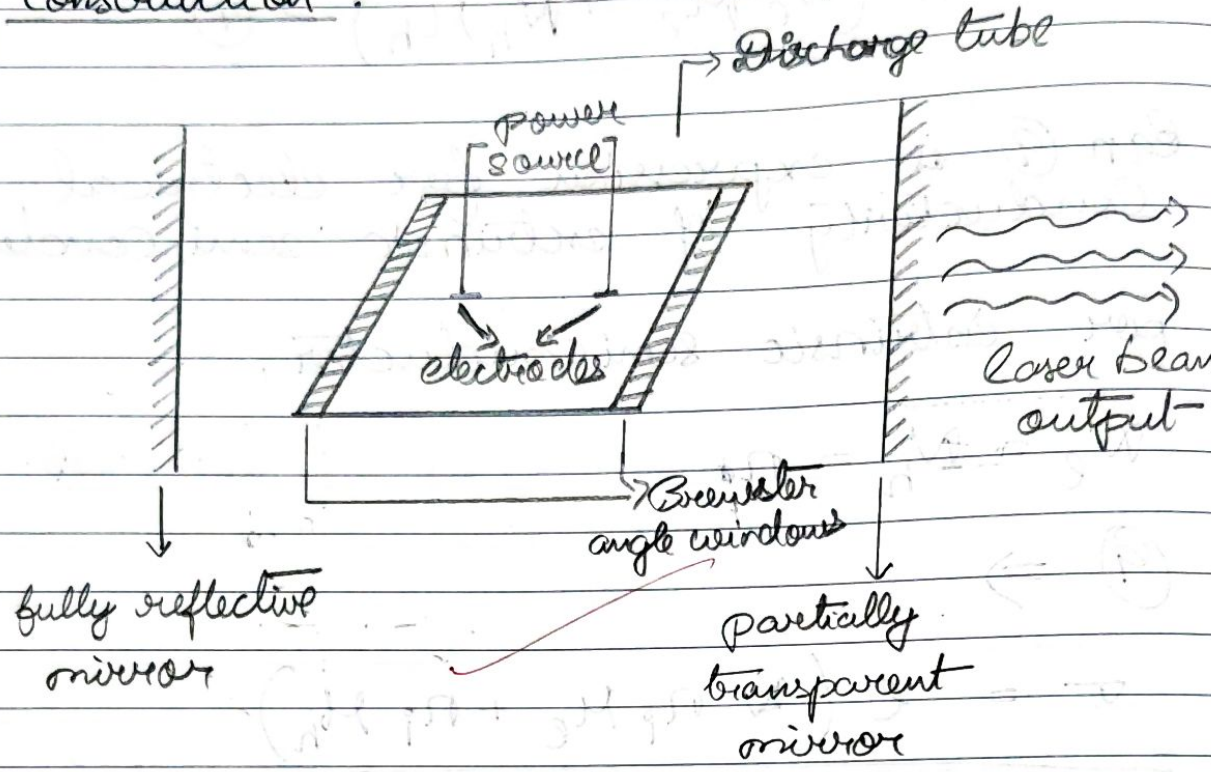
$$\boxed{\sigma = e n_i \left(\mu_e + \mu_h\right)} \quad -(10)$$

Eqn (10) represents expression for intrinsic semi conductor.

PART – B

4)a)

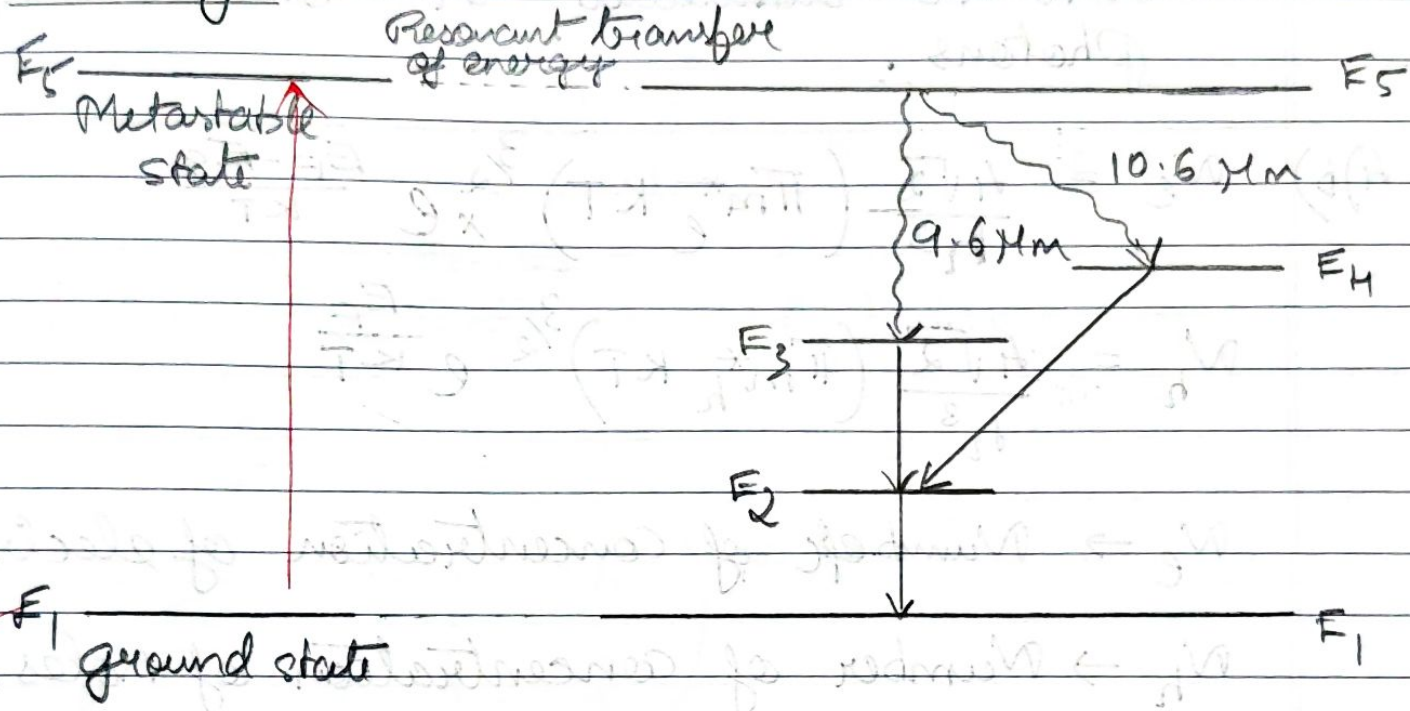
Construction :



- The active medium consists of CO_2, N_2 and He molecules in the ratio 1:2:3.
- The pressure of CO_2, N_2 and He are in the ratio 1:4:5.
- The discharge tube has two Brewster angle windows, which gives out Polarised beams.
- The discharge tube consists of two mirrors and the rear mirror provides optical feedback resonance for the emitted photons.

- N_2 molecules is metastable and is used to excite CO_2 molecules and He molecule enhances efficiency of CO_2.

Working:



- The vibrational mode of N_2 molecule is responsible for creating population inversion in CO_2 molecule.
- A very high DC voltage is supplied to the active medium and N_2 and CO_2 molecules absorb them.
- CO_2 and N_2, on absorbing energy gets excited to higher energy states which is metastable say E_5.

- The transition of ~~electrons~~ electrons takes from E_5 to E_H and E_5 to E_3 producing a radiation of ~~electrons~~ wavelength 10.6 μm and 9.6 μm respectively. This gives rise to ~~stimulated~~ the emissions of photons.

4)b) $$N_e = \frac{4\sqrt{2}}{h^3}\left(\pi m^*_e KT\right)^{3/2} \times e^{\frac{E_F - E_g}{KT}}$$

$$N_h = \frac{4\sqrt{2}}{h^3}\left(\pi m^*_h KT\right)^{3/2} e^{\frac{-E_F}{KT}}$$

$N_e \rightarrow$ Number of concentration of electrons.

$N_h \rightarrow$ Number of concentration of holes.

$h \rightarrow$ Planck's Constant

$m^*_e \rightarrow$ effective mass of electrons

$m^*_h \rightarrow$ effective mass of holes

$K \rightarrow$ Boltzman's constant

$T \rightarrow$ absolute temperature

$E_F \rightarrow$ Fermi energy, $E_g \rightarrow$ Energy gap

In an intrinsic semiconductor,

$$N_e = N_h$$

$$\frac{4\sqrt{2}}{h^3}\left(\pi m^*_e KT\right)^{3/2} \times e^{\frac{E_F - E_g}{KT}} =$$

$$\frac{4\sqrt{2}}{h^3}\left(\pi m^*_h KT\right)^{3/2} \times e^{\frac{-E_F}{KT}}$$

$$\left(m^*_e\right)^{3/2} e^{\frac{E_F - E_g}{KT}} = \left(m^*_h\right)^{3/2} \times e^{-\frac{E_F}{KT}}$$

$$\frac{e^{\frac{E_F - E_g}{KT}}}{e^{\frac{-E_F}{KT}}} = \left(\frac{m^*_h}{m^*_e}\right)^{3/2}$$

$$e^{\frac{2E_F - E_g}{KT}} = \left(\frac{m^*_h}{m^*_e}\right)^{3/2}$$

Apply natural log on both sides

$$\frac{2E_F - E_g}{KT} = \frac{3}{2} \ln\left(\frac{m^*_h}{m^*_e}\right)$$

$m^*_e = m^*_h$ in Intrinsic semiconductor

$$\frac{2E_F - E_g}{KT} = \frac{3}{2}\ln(1)$$

$$\frac{2E_F - E_g}{KT} = 0$$

$$2E_F - E_g = 0$$

$$2E_F = E_g$$

$$\therefore \boxed{E_F = \frac{E_g}{2}}$$

4) c) $E - E_F = 0.02\ eV \quad T = 400K$

$$f(E) = \frac{1}{e^{\frac{E-E_F}{KT}} + 1}$$

$$f(E) = \frac{1}{e^{\frac{0.02}{1.38\times10^{-23}\times400}} + 1}$$

$$f(E) = \frac{1}{e^{3.6831\times10^{18}} + 1}$$

$$f(E) = \frac{1}{}$$

$$E - E_F = 0.02 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-21} \text{ J}$$

$$f(E) = \frac{1}{e^{\frac{0.02\times1.6\times10^{-19}}{1.38\times10^{-23}\times400}} + 1}$$

$$f(E) = 0.3589 \text{ J m}^{-3}$$

30/30

M 2/3 | 2021

PART - A

2)a) Young's modulus is defined as the ratio of longitudinal stress to longitudinal strain.

$$Y = \frac{\frac{F}{a}}{\frac{x}{L}}$$

$$Y = \frac{FL}{ax}$$

where $Y \rightarrow$ young's modulus
$F \rightarrow$ force applied on the body
$a \rightarrow$ area of the body
$x \rightarrow$ change in length
$L \rightarrow$ original length

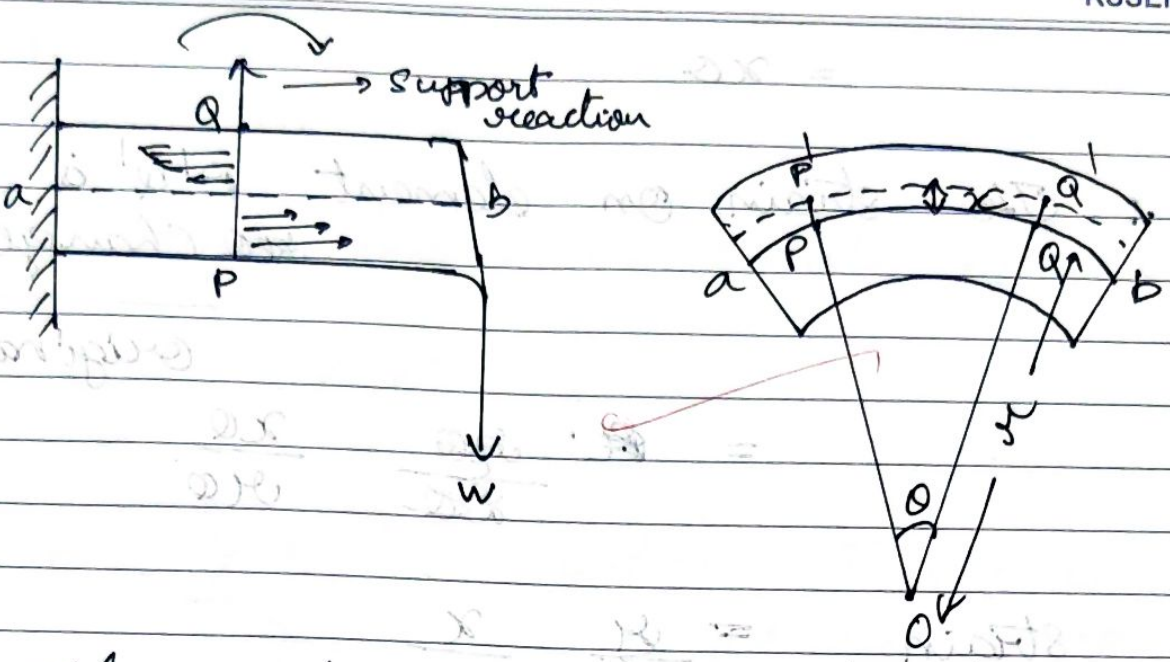
Rigidity modulus is defined as the ratio of tangential stress to tangential strain.

$$\eta = \frac{\frac{F}{a}}{\frac{l}{L}}$$

$$\eta = \frac{FL}{al}$$

where $\eta \rightarrow$ rigidity modulus
$F \rightarrow$ force applied on body
$a \rightarrow$ area of the body
$l \rightarrow$ change in length
$L \rightarrow$ original length

2)b)



Consider a beam rigidly fixed on one ~~side~~ end and ~~and~~ is loaded with weight 'W' on the other. Due to this there is a downward pull on one side and to balance this there is an upward reaction at 'Q'. The external bending of the beam is balanced by the internal bending moment and of couple of bending exists.

Consider that beam is bent to form an arc now we consider points P & Q. The angle between the points P & Q from point O is 'θ'. And are at a distance of 'rθ'. Consider element P'Q' the distance from point O is $(r+x)\theta$ ∴

∴ The length of element P'Q' is

$$= (r+x)\theta - r\theta$$

$= xo$

∴ The strain on element P'Q' is given as

change in length / original length

$= \frac{yy}{xo} \cdot \frac{xo}{yo}$

$\text{strain} = \frac{y}{R} \frac{x}{y}$

If 'Y' is young's modulus then the stress on element P'Q' is given by, Y · strain

$\text{stress} = Y \times \frac{y}{R} \frac{x}{y}$

If 'f' is force applied per unit length

$\frac{f}{a} = Y \times \frac{y}{R} \frac{x}{y}$

$f = \frac{Y a x}{y}$

∴ The bending moment at point x is given by

$B = f \times x$ ∴

$$B = \frac{\gamma a x^2}{r}$$

Bending along the whole beam is

$$B = \frac{\Sigma \gamma a x^2}{r}$$

$$\boxed{B = \frac{\gamma I}{r}}$$ where 'I' is moment of inertia

if 'K' is radius of gyration & 'A' is total crossectional area

$$\boxed{B = \frac{\gamma A K^2}{r}}$$

c) $n_1 = 1.55$ $n_2 = 1.5$

N.A = ? θ_0 = ? Δ = ?

$$N.A = \sqrt{n_1^2 - n_2^2}$$

$$= \sqrt{1.55^2 - 1.5^2}$$

$$N.A = 0.3905$$

$$N.A = \sin\theta_0$$

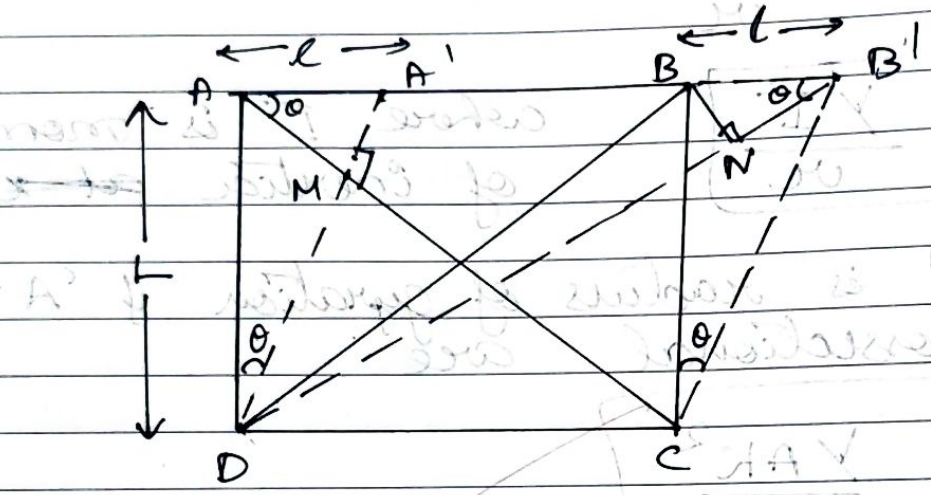
$$\theta_0 = \sin^{-1}(N.A)$$

$\theta_0 = \sin^{-1}(0.39051)$

$\theta_0 = 22.98 \simeq 23^\circ$

PART-B

3)a)



Consider a cube ABCD and a force is applied on the surface AB. Due to this the point A changes to A' & point B changes to B' and let 'θ' be the shear occuring in the cube.

Let α & β be the longitudinal and lateral stress coordinates.

The extention along DB due to tensile stress 'T' is $\alpha T \cdot DB$ and compression on DB due tensile stress 'T' is $\beta T \cdot DB$

∴ The total extention on DB is given by

$\alpha \cdot T \cdot DB + \beta \cdot T \cdot DB$

the extention on DB is NB'

from $\triangle BNB'$

$$\cos\theta = \frac{NB'}{BB'}$$

$$\frac{1}{\sqrt{2}} = \frac{NB'}{l}$$

$$\boxed{NB' = \frac{l}{\sqrt{2}}}$$

and diagonal $DB = L\sqrt{2}$

$$\therefore NB' = T \cdot DB \cdot (\alpha+\beta)$$

$$\frac{l}{\sqrt{2}} = T \cdot L\sqrt{2} \cdot (\alpha+\beta)$$

$$\frac{l}{LT} = 2(\alpha+\beta)$$

we know that $\frac{l}{L} = \theta$

$$\frac{\theta}{T} = 2(\alpha+\beta)$$

$$\frac{T}{\theta} = \frac{1}{2(\alpha+\beta)} = \eta$$

$$\eta = \frac{1}{2\alpha\left(1+\frac{\beta}{2}\right)}$$

$$\boxed{\eta = \frac{Y}{2(1+\sigma)}}$$

where $\eta \rightarrow$ rigidity modulus

$Y \rightarrow$ young's modulus

$\sigma \rightarrow$ poisson's ratio

3)b) $l = 1.5\ m \quad r = 0.0425 \times 10^{-2} m$

$\theta = \frac{\pi}{45}$ radian $\quad \eta = 8.3 \times 10^{10}\ N/m^2$

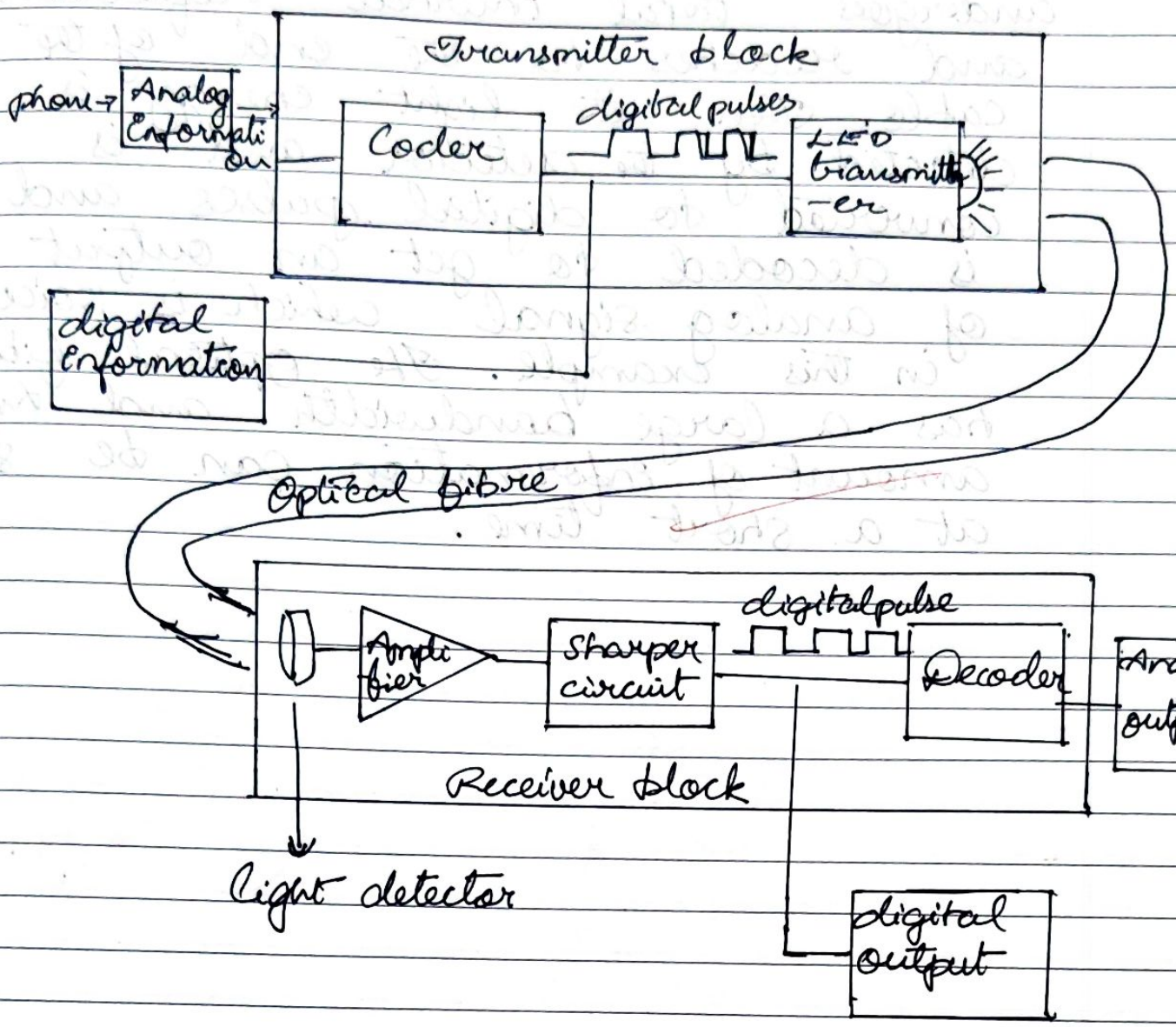
$$T = C\theta$$

$$T = \frac{\eta \pi r^4}{2l}\theta$$

$$T = \frac{8.3 \times 10^{10} \times \pi \times (0.0425 \times 10^{-2})^4 \times \pi}{2 \times 1.5 \times 45}$$

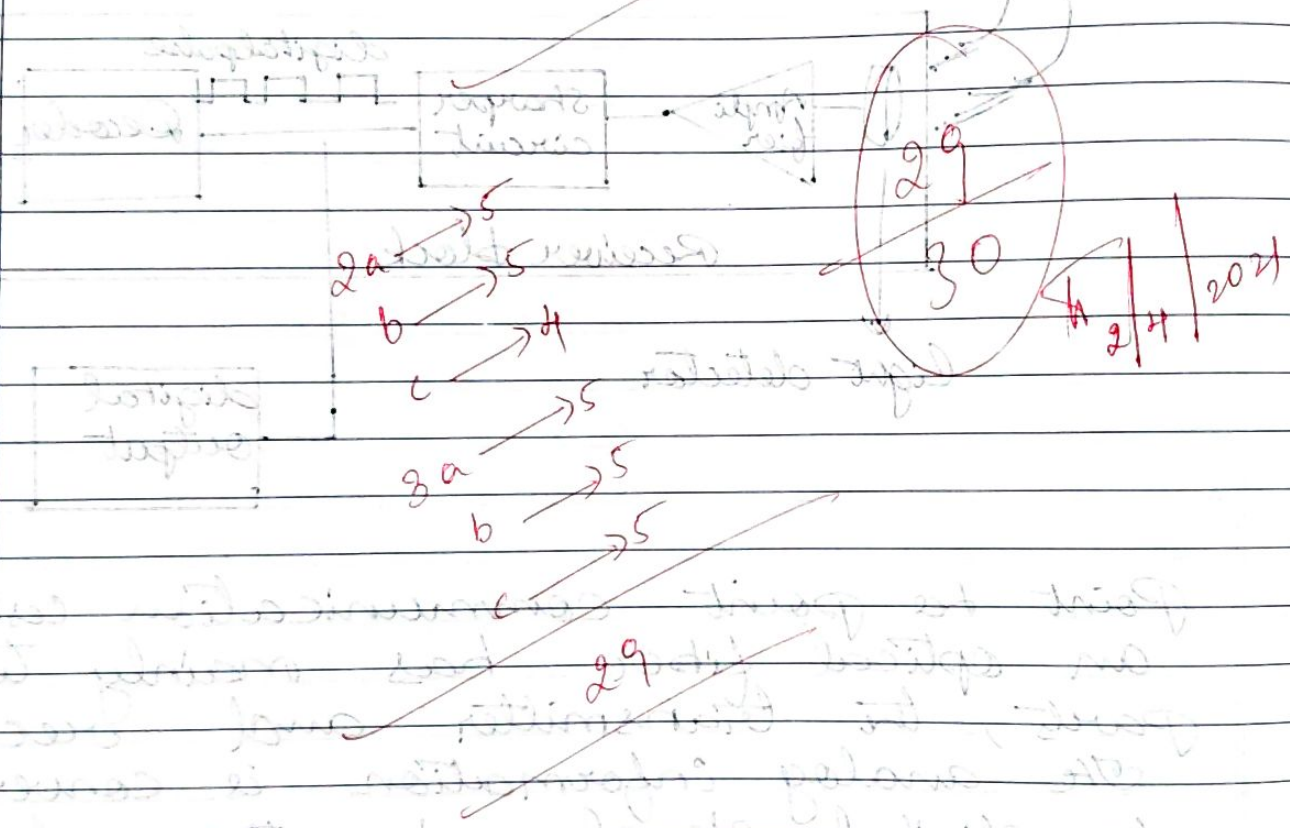
$$T = 8.908 \times 10^{-3}\ Nm \quad 4.949 \times 10^{-4}\ Nm$$

3) c)



Point to point communication using an optical fiber has mainly two parts, the transmitter and reciever. The analog information is converted to digital signal using the coder and the digital signal is converted to light energy by a LED transmitter. The transmitter then injects information to an optical fibre which then

undergoes total internal reflection and reaches to the end of the cable. Then the light energy is detected by the detector and is converted to digital pulses and is decoded to get an output of analog signal which is voice in this example. The optical fibre has a large bandwidth and higher amount of information can be sent at a short time.



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BLUE BOOK

Name of the Student: N. Manoj Raju

Class / Sem : VII th 'A' **Branch:** CSE

USN : 1 K G 1 7 C S 0 4 0

SUBJECT : SAN **Subject Code :** 17CS754

MAXIMUM MARKS : 40

Test	I	II	III	Average Marks Obtained
Date			8/01/21	23+10 (33)
Marks Obtained	23	30	16	
Signature of the Student			N. Manoj Raju	
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY : Deepa MG

SIGNATURE :

SIGNATURE OF H.O.D.

K S SCHOOL OF ENGINEERING AND MANAGEMENT

First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)			CO1	18
1(b)			3(b)				
1(c)			3(c)			CO2	5
OR			OR				
2(a)	5	CO1	4(a)	5	CO1		23/30
2(b)	5	CO1	4(b)	3	CO1		
2(c)	5	CO2	4(c)	0	CO2	Grand Total	

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	5	CO2	CO2	10
1(b)			3(b)	5	CO3		
1(c)			3(c)	5	CO3	CO3	28/30
OR			OR				
2(a)	5	CO2	4(a)				32/30
2(b)	5	CO3	4(b)				
2(c)	5	CO3	4(c)			Grand Total	

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	CO4	3(a)	5	CO4	CO4	11
1(b)	1	CO4	3(b)	—	—		
1(c)	5	CO5	3(c)	—	—	CO5	5
OR			OR				
2(a)			4(a)				16/30
2(b)			4(b)				
2(c)			4(c)			Grand Total	

21.1.21

Signature of the Staff

IA-1

SAN

2a)

1) Host - The Computers on which applications run are viewed to as hosts, Hosts can range from simple laptops to complex clusters of servers.

→ Host can be physical or virtual machines.

→ A Compute Virtualization Software enables Creating virtual machine on top of a physical Compute infrastructure.

2) Connectivity - Refers to the Interconnection between hosts or between a host and peripheral devices, such as printers or storage device.

→ Connectivity and Communication between host and Storage are enabled using physical Components, interface protocols.

3) Storage - Data created by individuals or business must not be stored so that it is easily accessible for further processing.

→ In a Computing environment, devices assigned for storing data are termed Storage devices or simply, Storage.

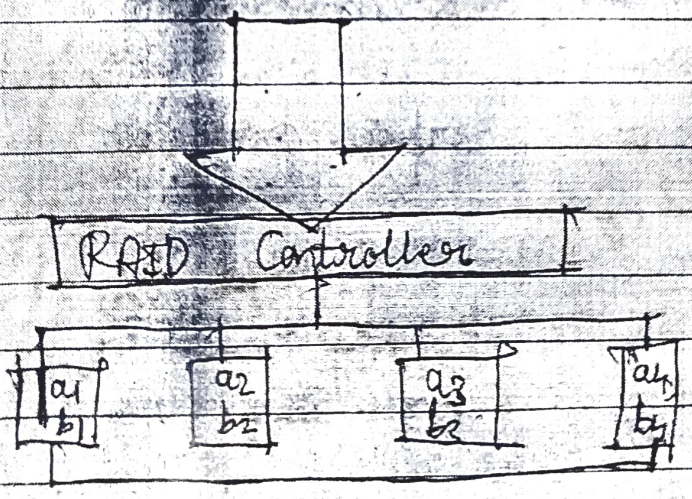
4) Application in the and virtual environment-

→ Performance
→ Cost & Complexity
→ Application requirements
→ Impact on backup and disaster recovery

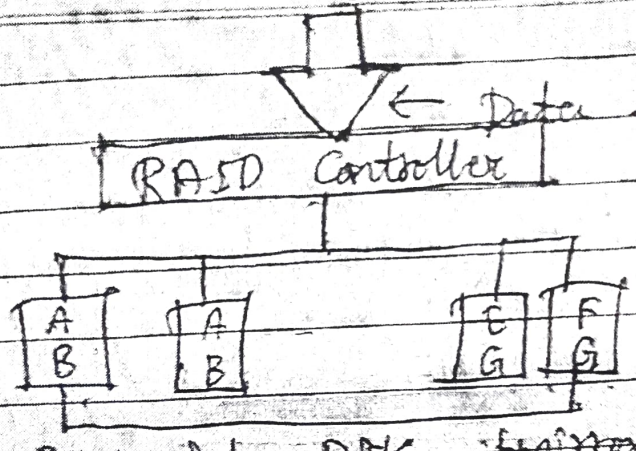
2) b) RAID- Redundant Array of Inexpensive disks is the use of small-capacity, inexpensive disk drives as an alternative to large capacity drive common on mainframe computers.

RAID levels-

→ RAID 0 - Classification uses data striping technique where data is striped across all the disks within a RAID set. Therefore it utilizes the full storage capacity of a RAID set.

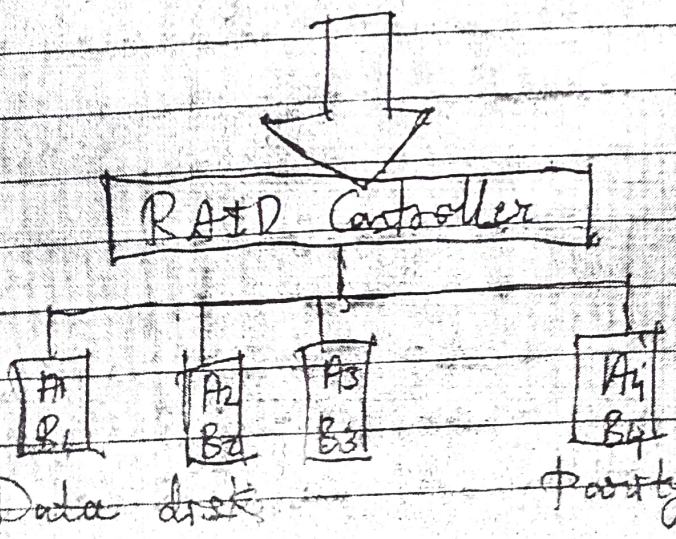


→ RAID 1 - is mirroring technique. In this RAID Configuration data is mirrored to provide fault tolerance



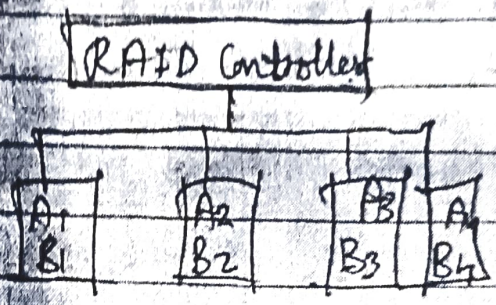
→ RAID 1/0 - It also known as RAID 1.0 performs well for workloads with small, random, write intensive I/Os. It is also called Stripped mirror.

→ RAID 3 - Stripes data for high performance and uses parity for improved fault tolerance. Parity information is stored on a dedicated drive so that data can be reconstructed if a drive fails.



→ RAID 4 - Stripes data for high performance and parity for improved fault tolerance. Data is striped across all disks except the parity disk in the array.

→ RAID 5 - Is a versatile RAID implementation. It is similar to RAID 4 because it uses striping. The drives are also ~~not~~ independently accessible.



2)c) Layers are -

* FC-4 upper layer protocol -

→ FC-4 is the uppermost layer in the FCP stack.

→ This layer defines the application interfaces and how upper layer protocols are mapped to lower FC layers.

→ The FC standard defines several protocols that can operate in the FC-4 layer.

* FC-2 Transport Layer -

→ The FC-2 is the transport layer that contains the payload, address of the source and destination ports, and link control information.

→ The FC-2 ~~is~~ layer provides fibre channel addressing, structure and organization of data.

* FC-1 (Transmission Protocol-

→ This layer defines the transmission protocol that includes serial encoding & decoding rules.

→ At the transmitter mode an 8-bit character is encoded into 10-bit transmission character.

* FC-0 Physical Interface-

→ FC-0 is the lowest layer in the FCP stack.

→ The layer defines the physical interface media and transmission of raw bits.

→ The FC transmission can use both electrical and optical media.

9(a) → Peak workload = 7500 I/o's
Read/Write ratio = 2:1

Therefore, Reads = 2/3 * 4500 = 3000 I/o's
and Writes = 1/3 * 4500 = 1500 I/o's
for RAID-6 write penalty is 6

∴ Disk load = (3000 * 1) + (1500 * 6)
= 3000 + 9000
= 12000 I/o's

4)b) Compute Virtualization -

→ Compute Virtualization is a technique for making or abstracting the physical hardware from the operating System.

→ It enables multiple operating Systems to run Concurrently on Single or clustered physical machines

→ This technique enables creating portable Virtual Compute Systems called Virtual machines (VMs) running its own operating System and application instance in an Isolated manner.

→ Compute Virtualization is achieved by a Virtualization layer that resides between the hardware and Virtual machines called the hypervisor. The hypervisor provides hardware resources, such as CPU, memory and network to all the Virtual machines.

4)c) Connections in a SAN are accomplished using Fibre Channel.

→ Fibre Channel Protocol is the Implementation of a Serial SCSI-3 over an F.C. network.

→ In the F.C. architecture, all external and remote storage is attached to the

SAN appears a ~~a~~ local devices to the host operating System.

The key advantages of FCP are as follows

→ Sustained transmission bandwidth over long distance.

→ Support for a larger number addressable devices over a network.

→ ~~Theoretically~~ Theoretically, FC can support over 15 million devices addresses on a network

→ ~~Exhibits~~ Exhibits the characteristics of channel transport and provides speed upto 8 5Gb/s.

2) c) Fibre Channel protocol stack-

→ It is easier to understand a communication protocol by viewing it as a structure of independ layers.

→ FCP defines the communication protocol in 5 layers - FC-0 through FC-4.

→ In a layered communication models the peer layers on each node talk to each other through defined protocols.

N. Manoj Rajan

1KG17CS040 (N. Manoj Raju)

(3rd Internal (SAN))

2) b) Backup and Restore Operations -

→ The backup server maintains the information about backup clients to be backed up and storage nodes to be used in a backup operation. The backup server retrieves the backup related information from the backup catalog and, based on the information, instructs the storage node to load the appropriate backup media into the backup devices.

→ It instructs the backup clients to ~~register~~ gather the data to be backed up and sent it over the network to the assigned storage node. ~~After backup data is sent to the storage~~ the client sends some backup metadata (the number of files, name of the files, storage node details, and so on) to the backup server.

→ The storage node then sends additional backup metadata (location of the data on the backup device, time of backup, ~~....~~ and so on) to the backup server. The backup server updates the backup catalog with this information.

→ ~~The storage node then sends~~
→ The storage node then ~~sends~~ receives the client data, organizes it, and sends it to the backup device.

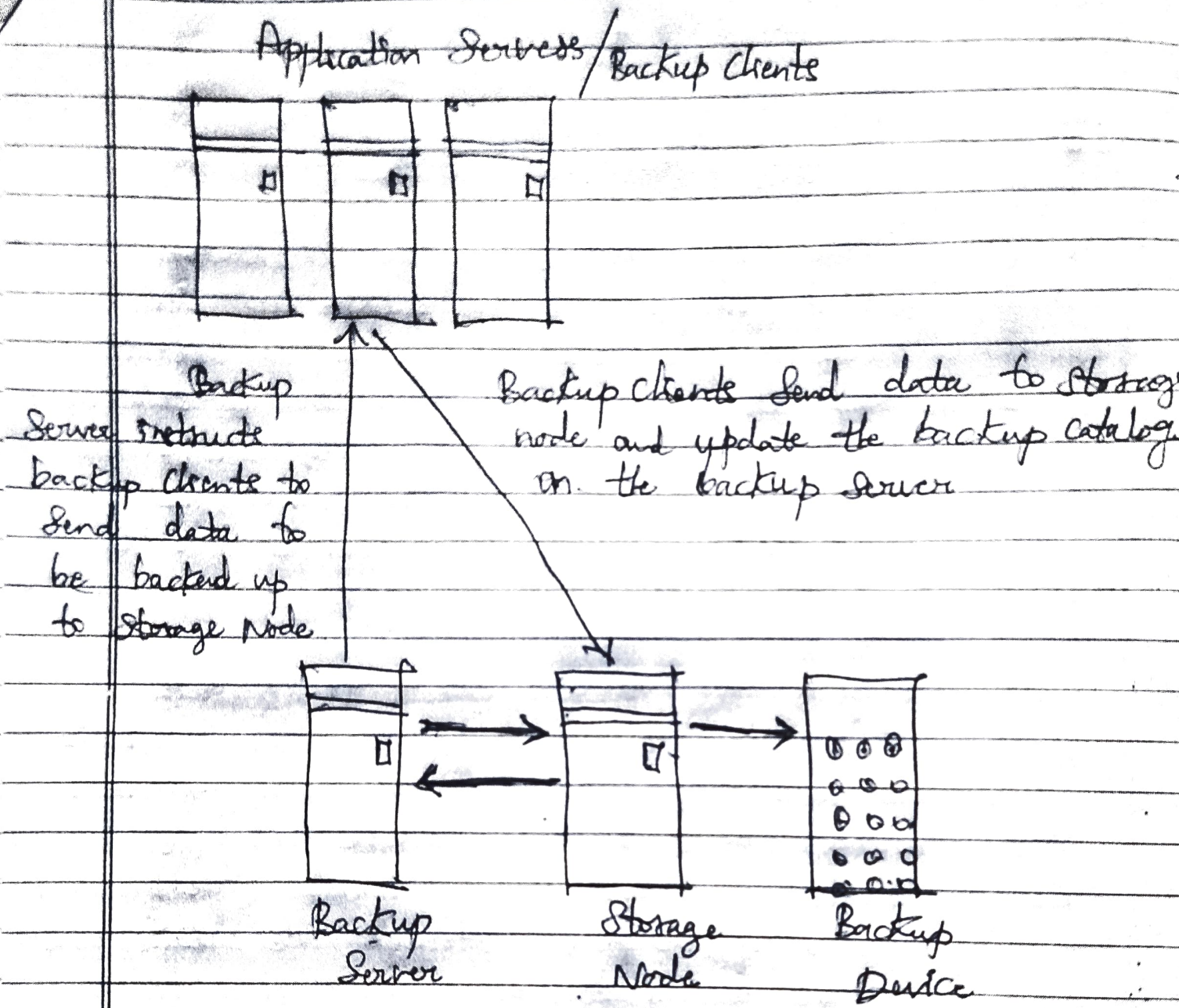


Fig Backup Operation

→ Upon receiving a restore request, an administrator opens the Restore application to view the list of clients that have been backed up.

→ While selecting the client for which a restore request has been made, the administrator also needs to identify the client that will receive the

restored data.

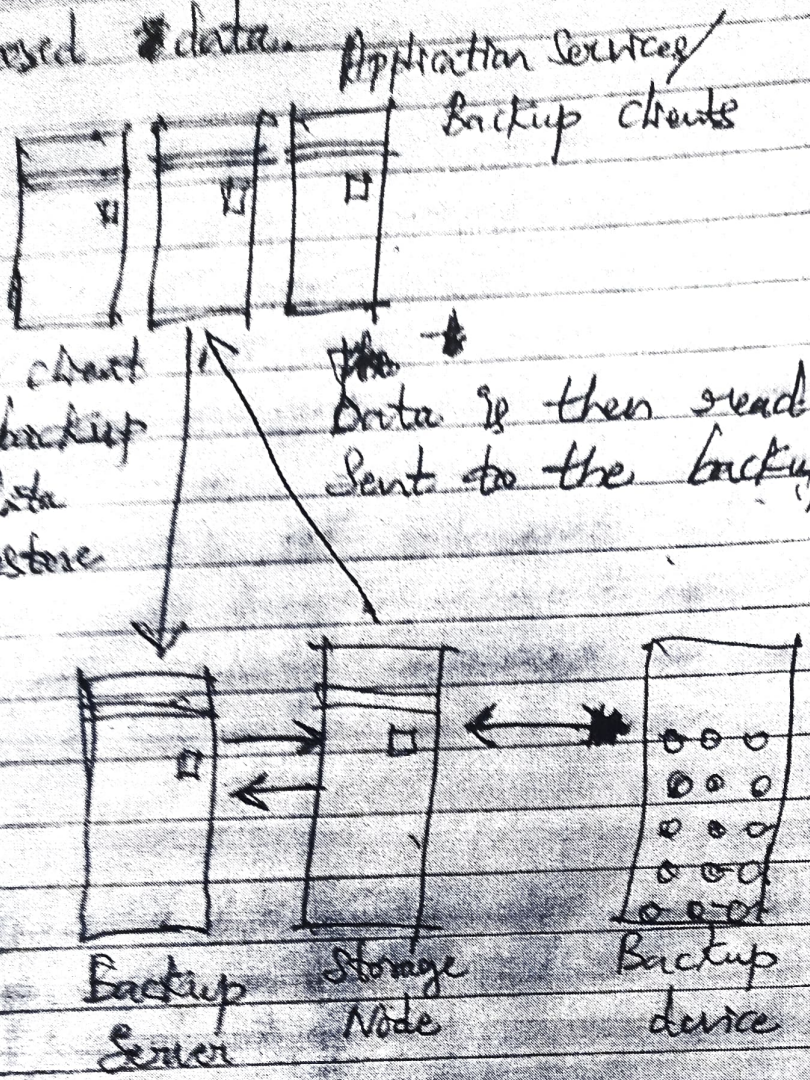


Fig: Restore operation

→ The backup server instructs the appropriate storage node to mount the specific backup media onto the backup device. Data is then read and sent to the client that has been identified to receive the restored data.

2)a) Object Storage and Retrieval in OSD -

→ The process of storing objects in OSD is illustrated in figure.

→ The data storage process in an OSD System is as

follows-

1) The application Server generates the file to be stored to the OSD node.

2) The OSD node divides the file into 2 parts- user data and meta data.

3) The OSD node generates the object ID using a specialized algorithm.
The algorithm is executed against the content of the user data to derive an ID unique to this data.

4) For future access, the OSD node stores the metadata and object ID using the metadata service.

5) The OSD node stores the user data (objects) in the storage device using the storage service.

6) An acknowledgment is sent to the application Server stating that the object is stored.

1KG17CS040

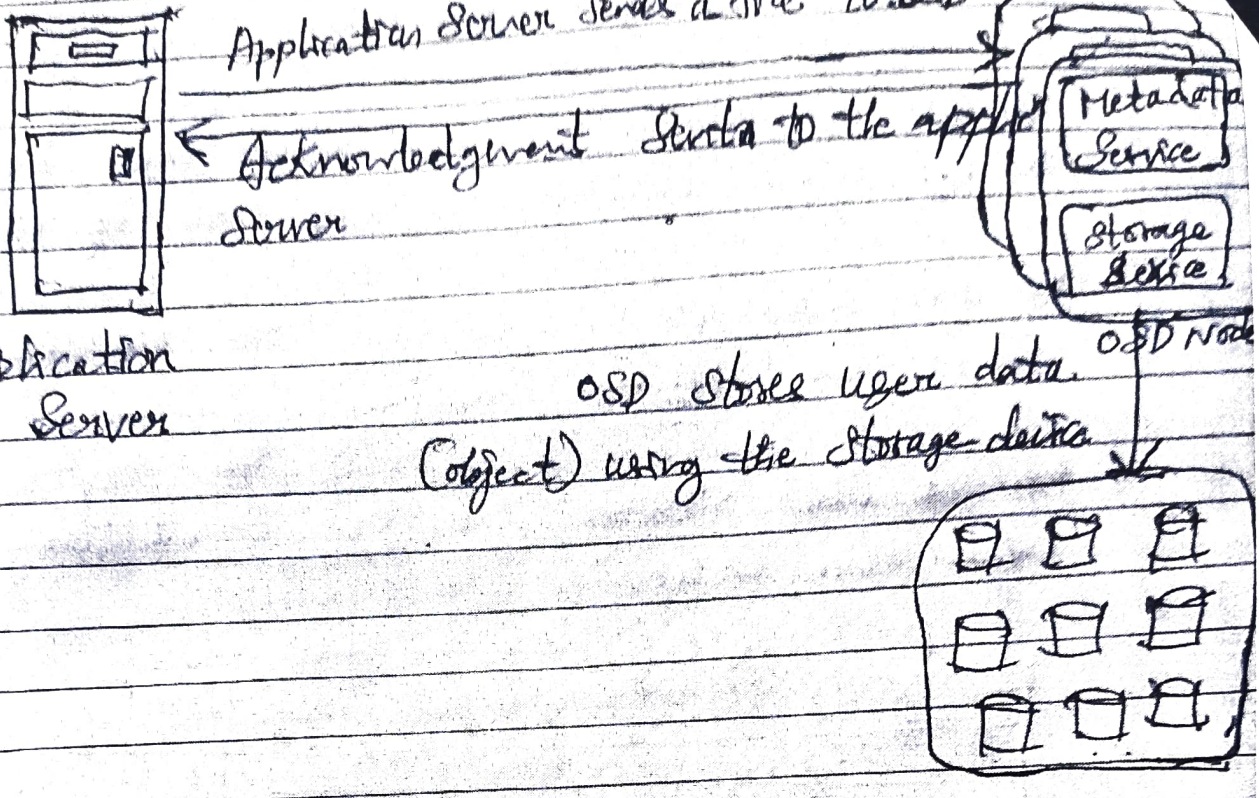


Fig: Storing objects on OSD

→ A user accesses the data stored ~~contents~~ on OSD by the same filename.

→ The process of retrieving objects in OSD is illustrated in figure. The process of data retrieval from OSD is as follows -

1) The application Server sends a read request to the OSD System.

2) The metadata Service retrieves the object ID for the requested file.

3) The metadata Service Sends the object ID to the application Server.

4) The application Server Sends the Objects ID to the OSD Storage Service for object Retrieval.

5) The OSD Storage Service retrieves the object from the Storage device.

6) The OSD Storage Service Sends the file to the application Server

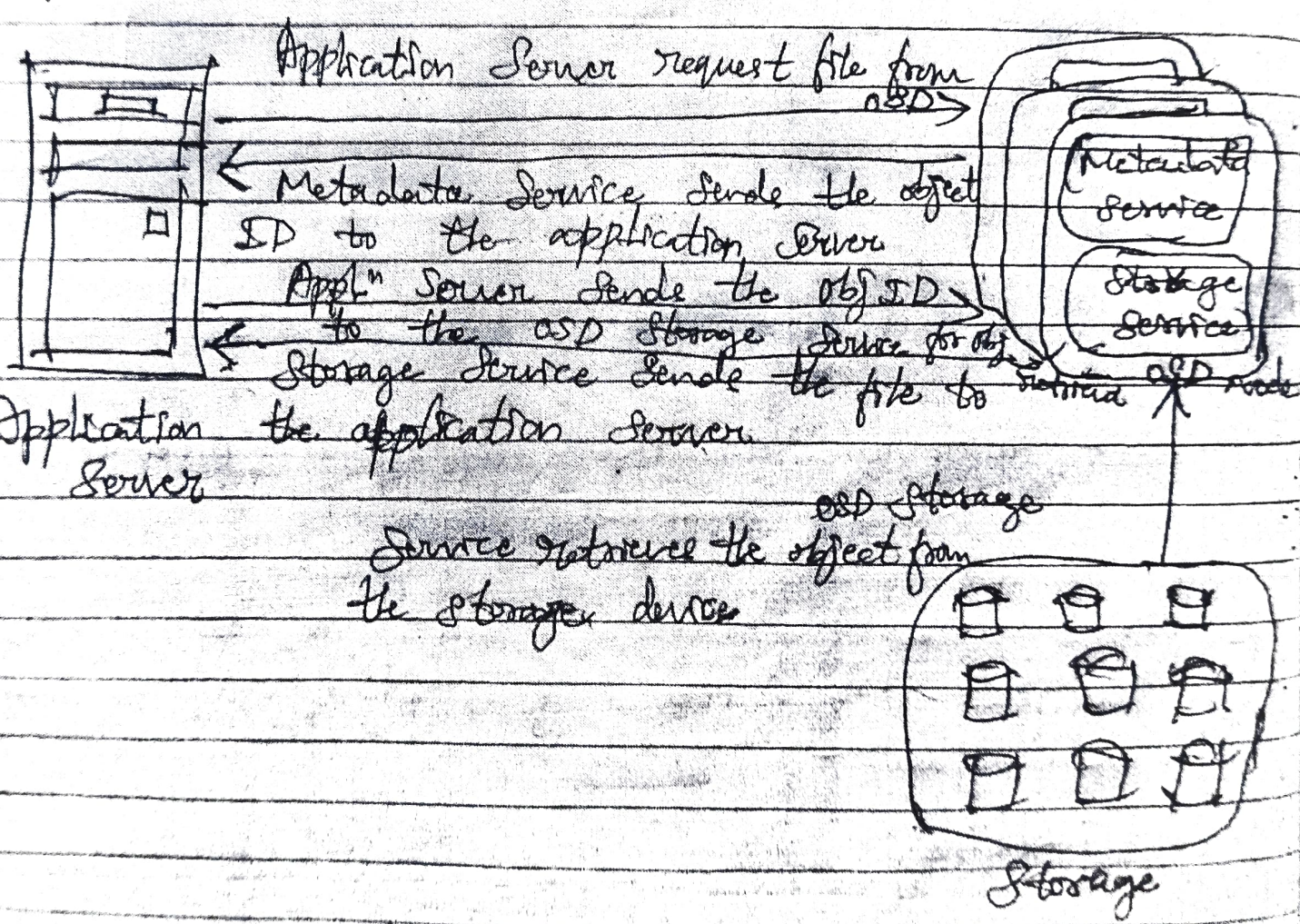


Fig: Object retrieval from an OSD System

Backup Topologies

3. basic topologies are used in a backup environment.

1) Direct - attached backup
2) LAN - based backup
3) SAN - based backup
4) the mixed topology

→ In a direct - attached backup, the storage node is configured on a backup client, and the backup device is attached directly to the client. only the metadata is sent to the backup server through the LAN. This configuration frees the LAN from backup traffic.

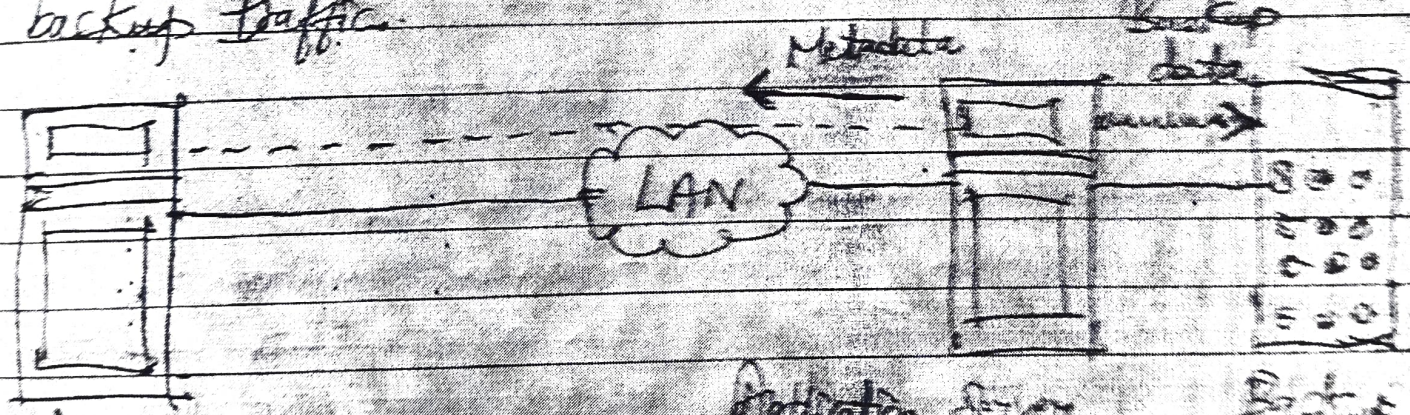


Fig: Direct attached topology

→ In a LAN - based backup, the client, backup server, storage node and backup device are connected to the LAN. The data to be backed up is transferred over the LAN to the backup device (destination)

over the LAN, which might affect network performance.

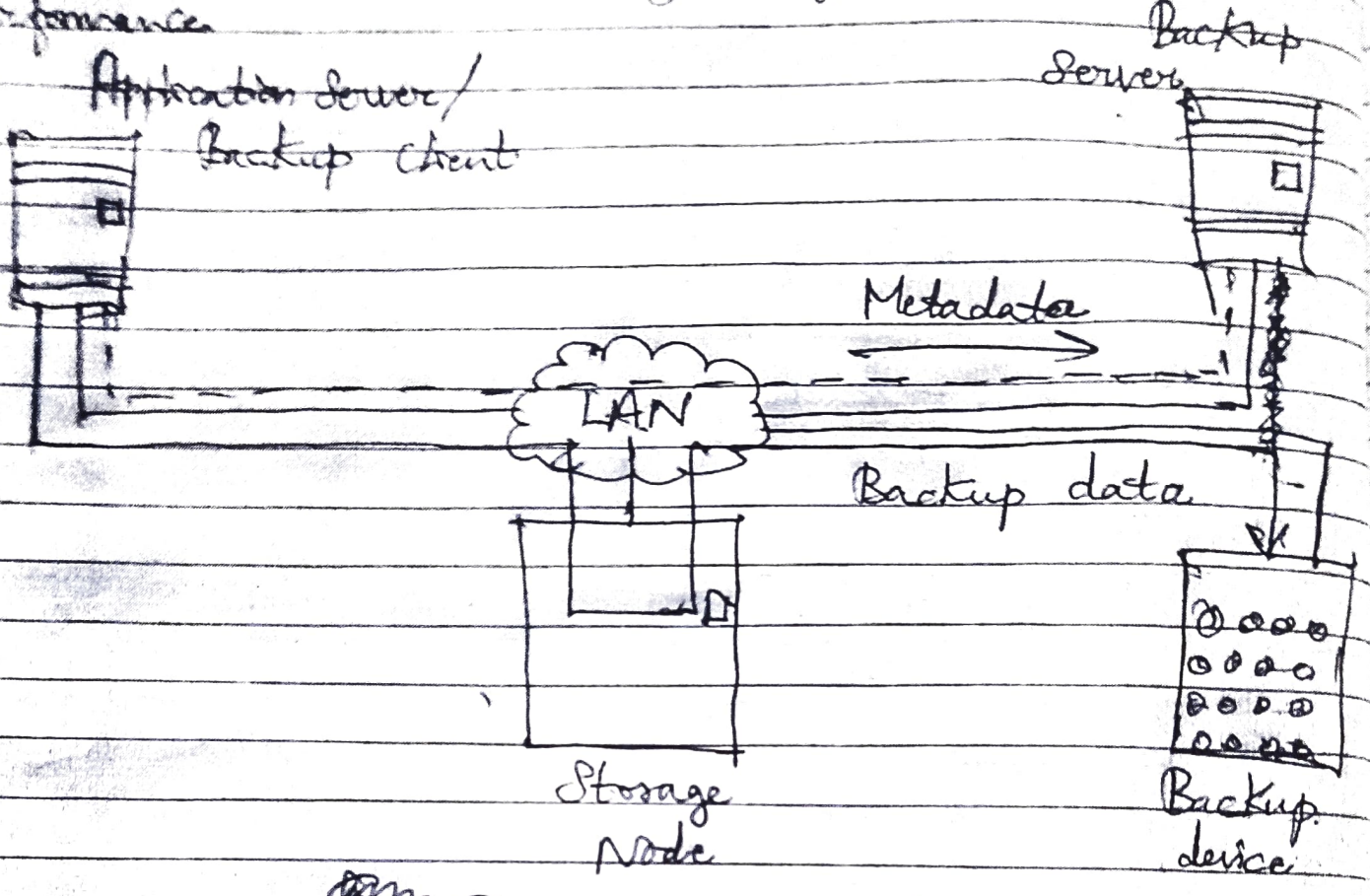


Fig: LAN-based backup topology

→ A SAN-based backup is also known as a LAN-free backup. The SAN-based backup topology is the most appropriate solution.

When a backup device needs to be shared among clients. In this case, the backup device and clients are attached to the SAN.

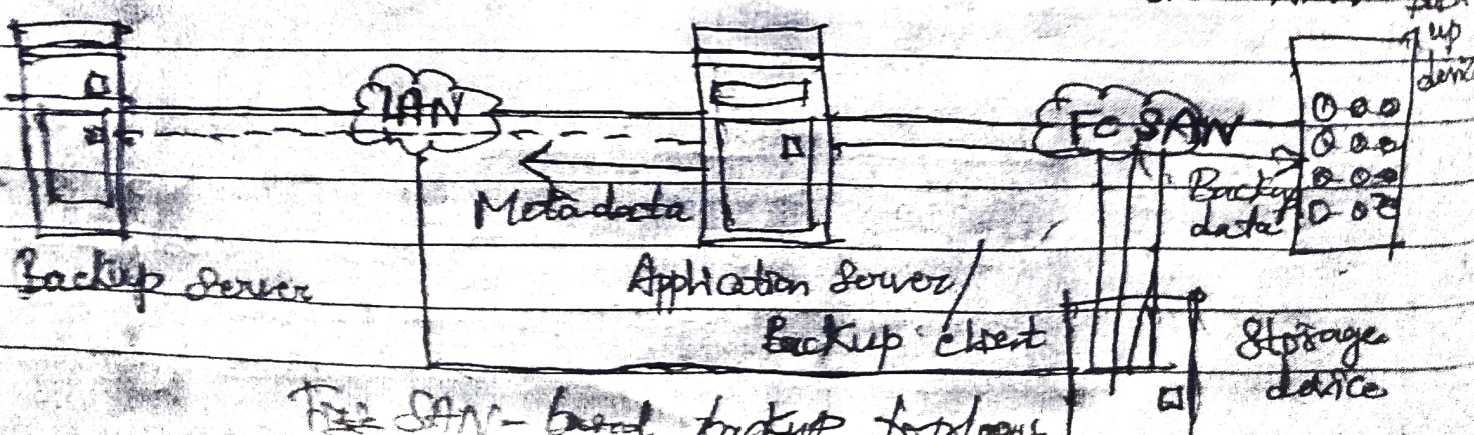


Fig: SAN-based backup topology

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Data Deduplication Implementation-

4b)

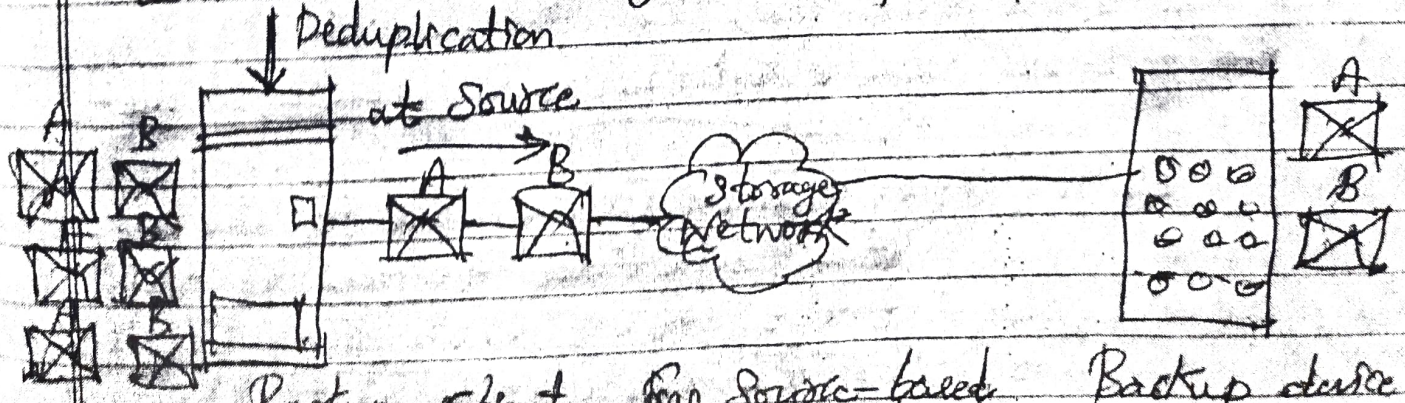
1) Source - Based Data Deduplication-

→ Source - based data deduplication eliminates redundant data at the source before it transmits to the backup device.

→ Source-based data deduplication can dramatically reduce the amount of backup data sent over the network during backup processes.

→ It provides the benefits of a shorter backup window and requires less network bandwidth. There is also a substantial reduction in the capacity required to store the backup images.

→ Defn: Data deduplication is the process of identifying and eliminating redundant data. When duplicate data is detected during backup, the data is discarded and only the pointer is created to refer the copy of the data that is already backed up.



Backup Client Fig: Source-based data deduplication Backup device

→ Target - Based Data deduplication

→ Target - based data deduplication is an alternative to Source - based data deduplication.

→ Target - based data deduplication occurs at the backup devices

→ which offloads the backup client from the deduplication process.

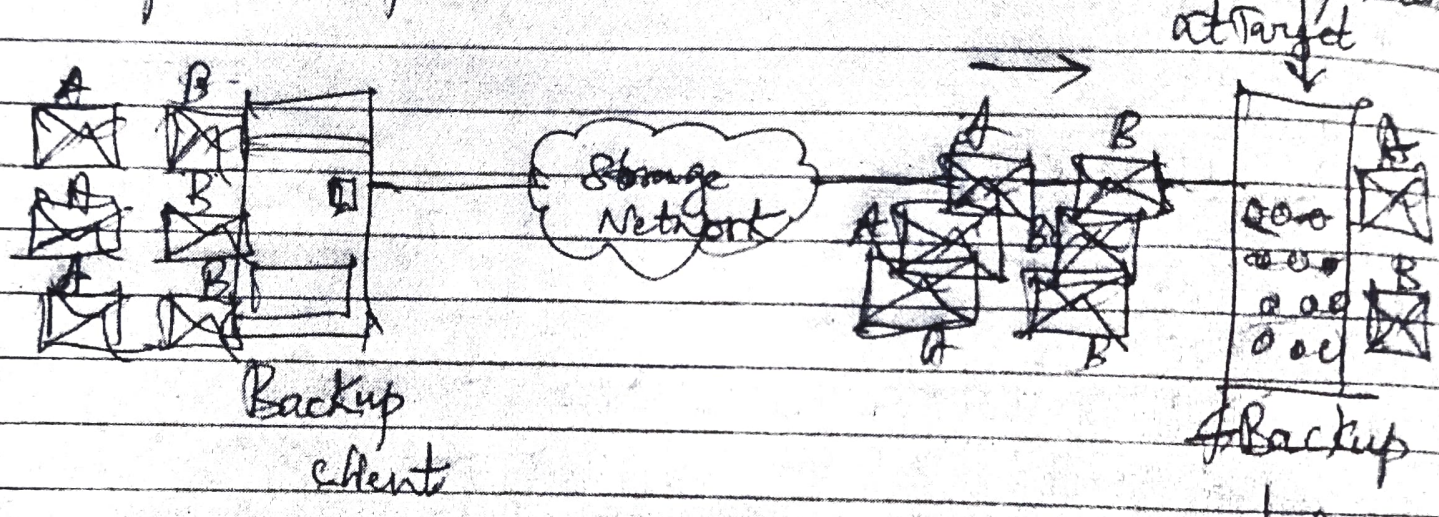


Fig: Target - based data deduplication

→ Target - based data deduplication does not require any changes in the existing backup software.

4) c) a) Synchronous Replication Mode -

→ In array - based synchronous remote replication writes must be committed to the source and the target to acknowledging "write complete" to the production host.

→ Additional writes on that source cannot occur until each preceding write has been completed and acknowledged.

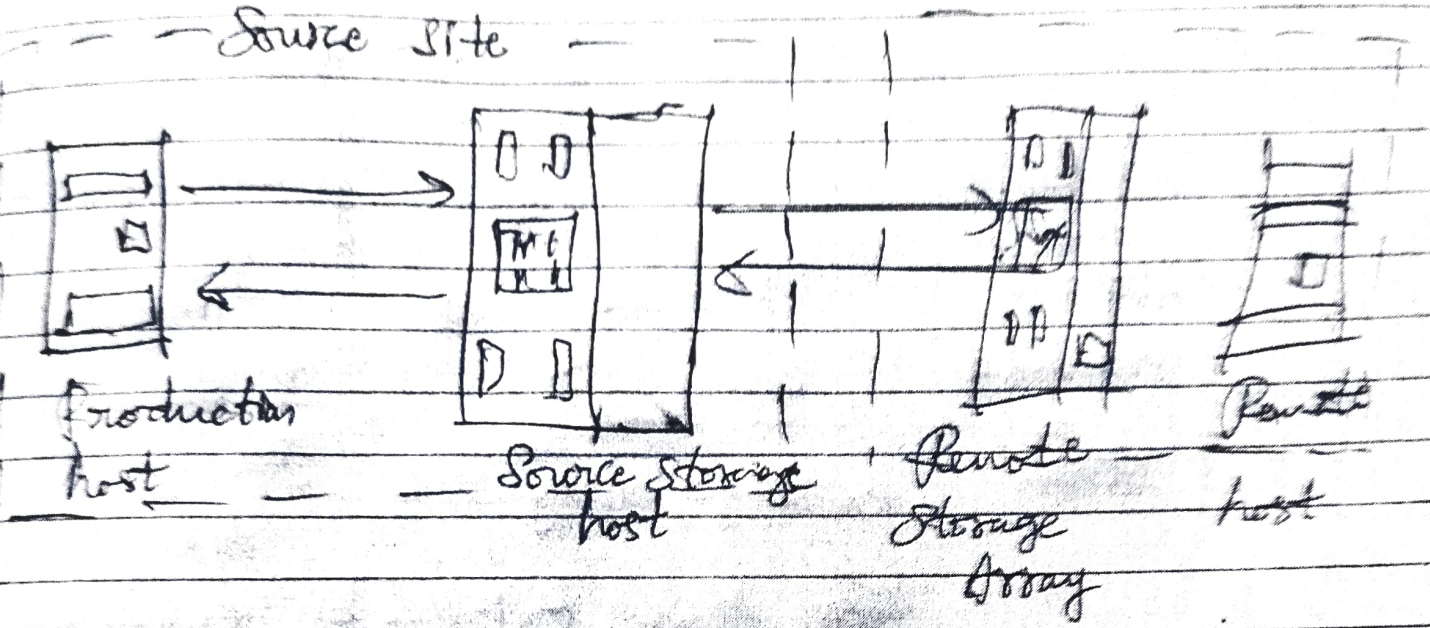


Fig: Array-based Synchronous remote replication

→ b) Asynchronous Replication Mode:-

→ In array-based asynchronous remote application mode, a write is committed to the source and immediately acknowledged to the host.

→ Data is buffered at the source & transmitted to the remote site later.

→ The source & the target device do not contain identical data at all times.

→ The data on the target device is behind

1KG17CS040

that of the Source, & the RPO in this case is not zero.

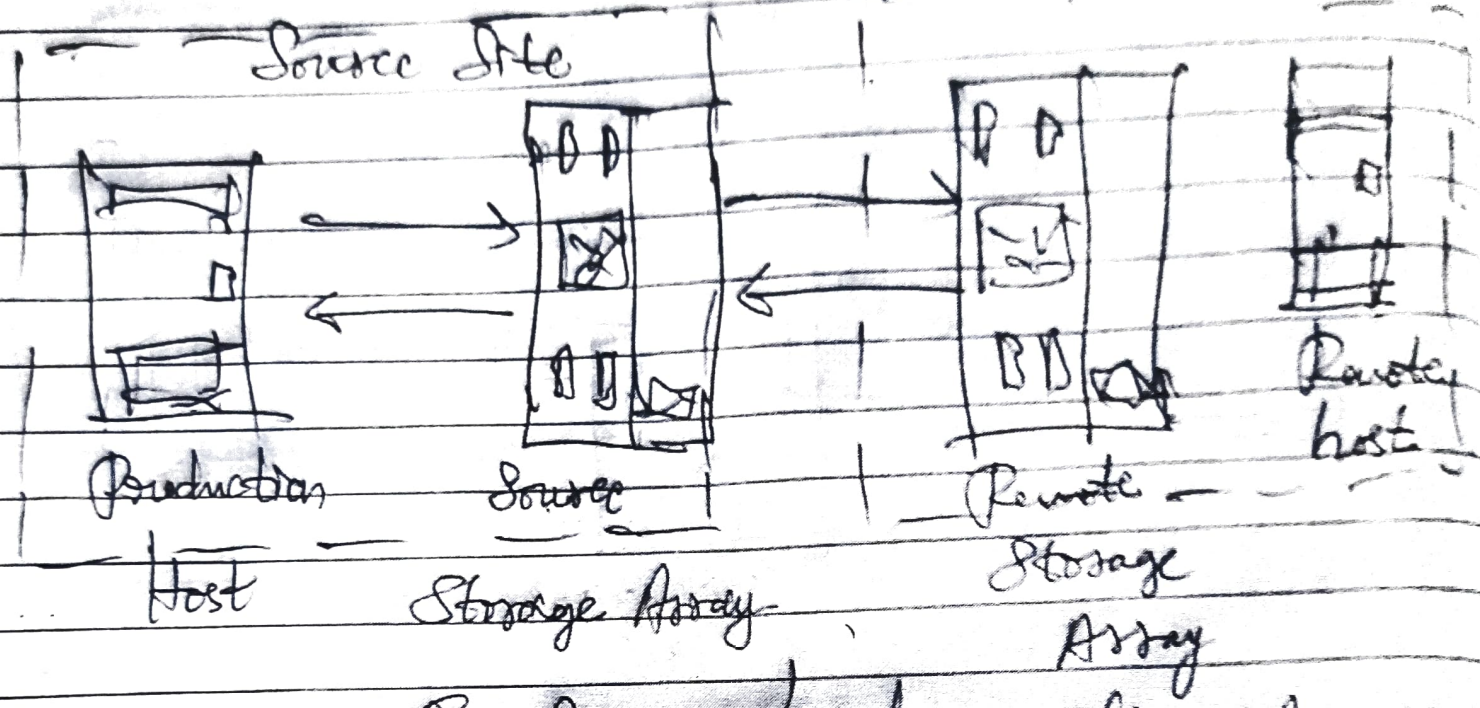


Fig: Array - based asynchronous Remote replication

→ Asynchronous replication writes are placed in cache on the two arrays & are later destaged to the appropriate disks.

4) a) Components of NAS -

→ NAS device has 2 key components (In figure) NAS head and Storage

→ NAS head includes the following components -

→ CPU & Memory

18CS646

→ NFS, CIFS and other protocols for file sharing

→ one or more network interface cards (NICs), which provide connectivity to the clients.

⇒ The process of handling I/Os in a NAS environment –

1) The NAS device converts the I/O request into an appropriate physical storage request, which is a block-level I/O, and then performs the operation on the physical storage.

3) The NAS device receives data from the storage, it processes and repackages the data into an appropriate file protocol response.

4) The requestor (client) packages an I/O request into TCP/IP and forwards it through the network stack

→ The NAS device receives this request from the network.

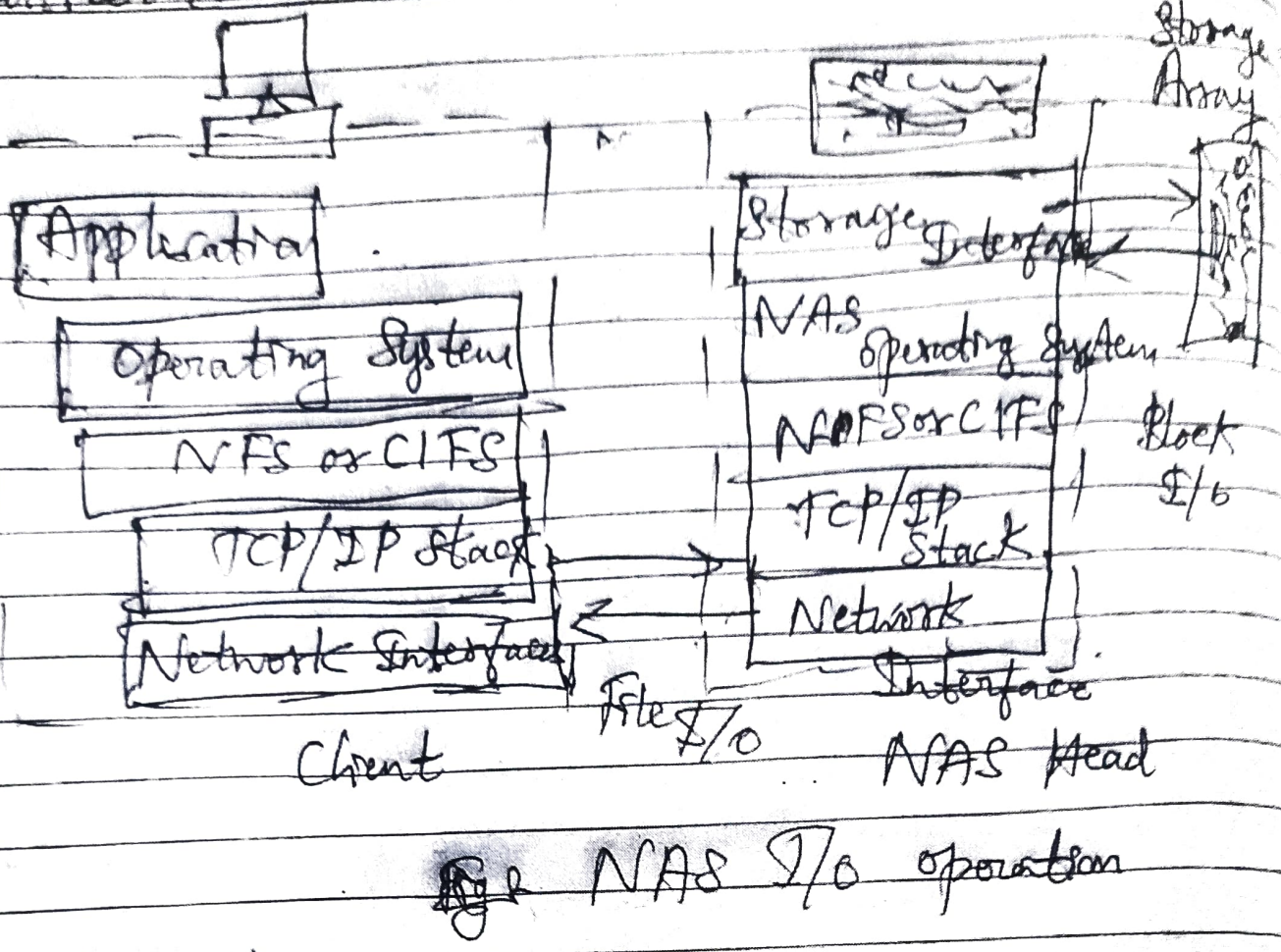


Fig: NAS I/O operation

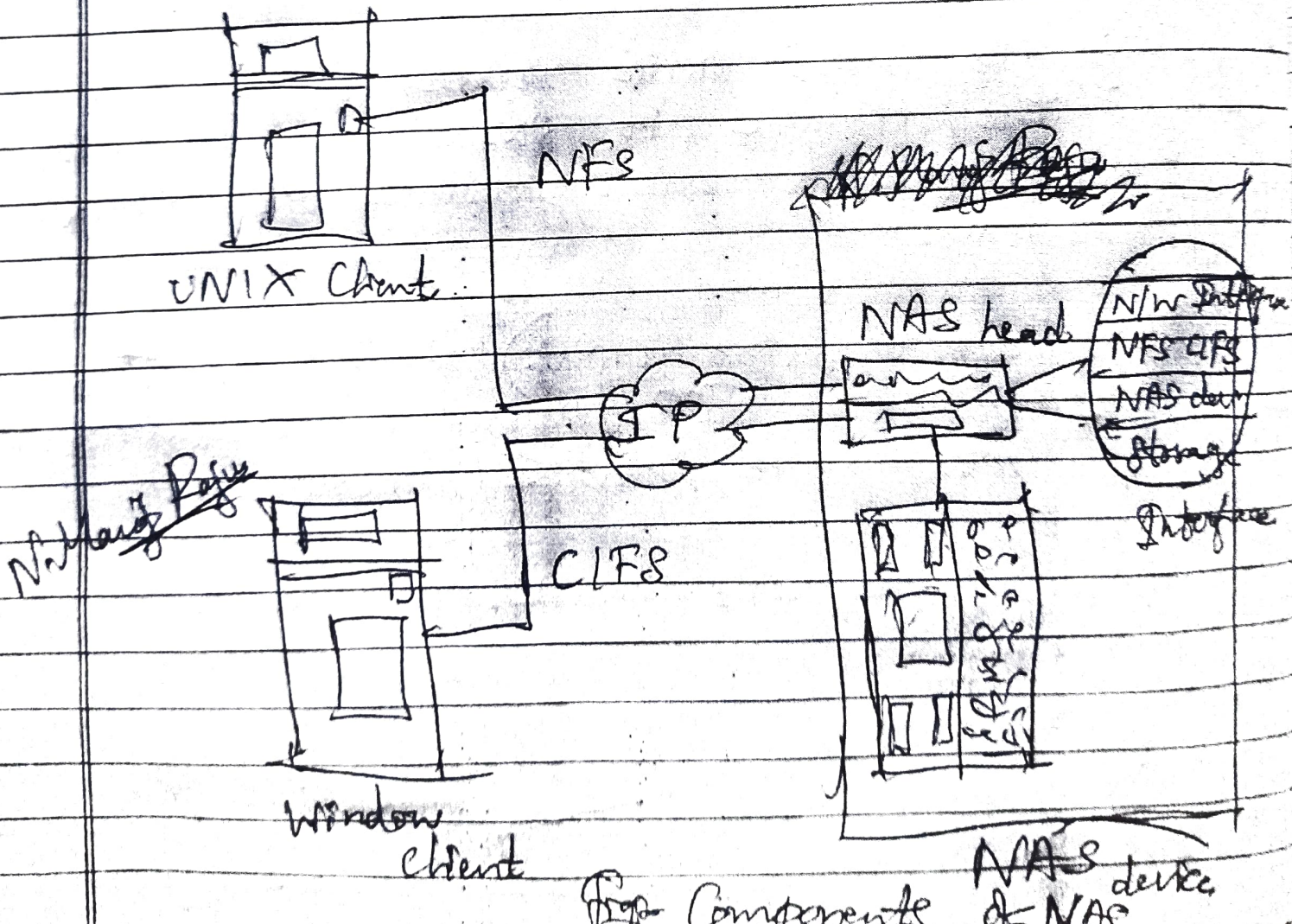


Fig: Components of NAS

III rd DA

SAN

3)a) 5 essential Characteristics are-

→ on-demand Self Service

→ Broad Area Network

→ Resource Pooling

→ Rapid Elasticity

→ Measured activity

~~⇒ on-demand Self Service-~~

~~→ Enables Consumers to choose unilaterally provisioned Services and request via to clients via user web-based interfaces and it requests for a provisioned Service.~~

⇒ Broad Area Network-

→ Computing Capabilities are accessed over the network.

→ Computing Capabilities can be accessed by the clients broad platforms such as-
- Mobile devices
- Laptop
- Desktop Computing
- Tablet.

⇒ On-demand Self Service -

→ Enables Consumers to access unilaterally provisioned Computing Capabalities via user web-based network interfaces.

→ It Sents request for a provisioned service.

⇒ Resource Pooling -

→ the provisioned service Resources are pooled to serve many Consumers with multitanted model.

→ Consumers have no exact knowledge or control of where the provisioned Resource is stored.

⇒ Rapid Elasticity -

→ Consumer Service Resource can be elastically provisioned & regulated.

→ Consumers Resource can be Scaled Rapidly. To make sense of unlimited Scalability.

→ Measured Activity -

→ Helps to control or optimize the resource use.

→ Helps in generating billing and stackback of Records.

Cloud Computing is one of the most important and used by many applications Software based Service.

Benefits are -

→ Stored

→ Distributed Computing

→ utility Computing

→ Virtualization

→ SoA

Stored

⇒ Distributed Computing -

→ For Stored distributed System.

→ Enables Resources of the Consumer network in the network to perform the Same

task on the network.

⇒ Utility Computing
Enables consumers use different utilities provided while Computing in the network and perform operations.

⇒ Virtualization-

→ Implementing and working Virtual Machines, virtual storage instances and virtual networks.

⇒ SOA-

→ provides set of services that can host together.

1)a) Cloud Computing Infrastructure-

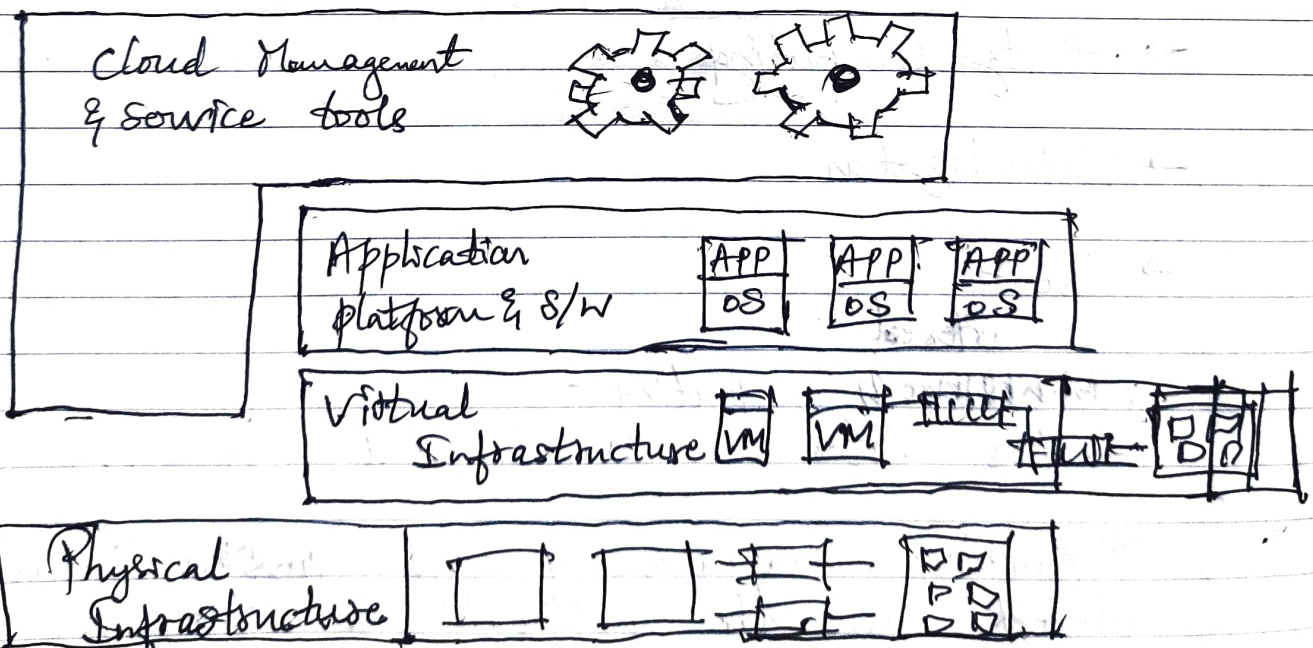


Fig: Cloud Computing Infrastructure

→ The function of the Infrastructure of the Cloud Computing is explained as follows.

→ The figure Cloud Computing infrastructure consists of Cloud Management and Service tools.

→ It has a Application platform & Software.

→ Infrastructure is with a virtual infrastructure with virtual machines.

→ Consists of physical Infrastructure as shown in the figure.

Physical Infrastructure-

→ Physical Infrastructure also includes

- Physical Infrastructure Service
- Physical Servers
- Storage System
- Network.

→ Physical Servers are Connected with each other the network and to the clients in the network. Servers.

→ Physical Resources -

Physical Resources are stored in a single data Center or distributed accross multiple data Center.

→ Virtual Infrastructure Consists of VM's virtual machines for the process and the Application platform & software has operating Systems which Serves different purpose in the infrastructure. Also with the different tools in the cloud management for different Services.

D c) → Information Life Cycle Management is all about managing the data or information into the cloud which happens to be a continous process to provide service.

Challenges -

→ Consumer's perspective -

→ Security and Regulation -

→ the Consumers are indecesive of transfer to control of the Sensitive data.

→ Prevents the organization to free the

Cloud Services.

* Network Latency-

→ Real time applications suffer due to network latency and limited bandwidth.

* Supportability-

→ Restricts the consumers from changing the Cloud Services.

→ Provisioned resources doesn't support the proprietary environment.

⇒ Providers Perspective→

* Service guaranty & Service Cost

→ Resources should be ready to meet the unpredicted demand.

* Complexity in deploying vendors in the cloud-

→ Not all vendors provide ready-cloud Software licence.

→ High-cost of ready-cloud Software licenses.

No Standard Cloud access interface -

→ Consumers want open APIs.

→ Need agreement among the providers for standardization.

D) → Software-as-a-Service is one of the service in Cloud Computing.

→ It allows users to access and work with different softwares like Microsoft Azure, Hadoop etc.

→ Very reliable and efficient working.

→ A software based Cloud Computing service.

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Assignment 10

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BLUE BOOK

Name of the Student: BHARGAV.M

Class / Sem : III RD SEM Branch: CIVIL

USN : 1 K G 2 0 C V 4 0 1

SUBJECT : ENGINEERING GEOLOGY Subject Code : 18CV36

MAXIMUM MARKS : 40

Test	I	II	III	Average Marks Obtained
Date	17.10.2020	19.11.2020	9.1.2021	26
Marks Obtained	20	17	10	
Signature of the Student	Bhargav.M	Bhargav.M	Bhargav.M	Bhargav.M
Initials of Room Supervisor			B.M	
Initials of Faculty				

NAME OF FACULTY : Dr. Yashas.

SIGNATURE :

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	4	1	3(a)			1	13
1(b)	4	1	3(b)				
1(c)	5	2	3(c)			2	7
OR			OR				
2(a)			4(a)	2	1		
2(b)			4(b)	3	1		
2(c)			4(c)	2	2	Grand Total	20

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	4	2	3(a)	4	2	2	8
1(b)	3	3	3(b)	2	3		
1(c)	2	3	3(c)	2	3	3	9
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	17

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)			4	8
1(b)			3(b)				
1(c)			3(c)			5	2
OR			OR				
2(a)	2	4	4(a)	3	4		
2(b)	3	4	4(b)				
2(c)	1	5	4(c)	1	5	Grand Total	10

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BLUE BOOK

Name of the Student: ANUSH KC

Class / Sem : III Sem **Branch:** EEE

USN : 1 K G 1 9 E E 0 0 1

SUBJECT : EEM **Subject Code :** 18EE36

MAXIMUM MARKS : 30+10=40

Test	I	II	III	Average Marks Obtained
Date	7/10/2020	19/11/2020	1/03/21	21+10
Marks Obtained	23	30	10	=31
Signature of the Student				
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY : Tejaswini G.V.

SIGNATURE :

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	3.5	CO1	3(a)	5	CO1	CO1	19
1(b)	4	CO1	3(b)	5	CO1		
1(c)	NA	CO2	3(c)	4	CO2	CO2	4
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	23/30

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	CO2	3(a)	5	CO2	CO2	10
1(b)	5	CO3	3(b)	5	CO3		
1(c)	5	CO3	3(c)	5	CO3	CO3	20
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	30/30

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	½	CO4	3(a)	2½	CO4	CO4	06
1(b)	3.	CO4	3(b)	NA	CO4		
1(c)	3	CO5	3(c)	1	CO5	CO5	04
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	10/30

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Dept. of Mechanical Engineering KSSEM

BLUE BOOK

Name of the Student: SHRIKAR. S

Class / Sem : VII SEMESTER Branch: MECHANICAL

USN : 1 K G 1 7 M E 0 3 5

SUBJECT : FPS Subject Code : 17ME72

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date			05/01/2021	
Marks Obtained			27	
Signature of the Student			Shrikar	
Initials of Room Supervisor			Moh	
Initials of Faculty			Y	

NAME OF FACULTY : Harsha. T

SIGNATURE : Harsha

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	4	3(a)				
1(b)	5	4	3(b)			4	19
1(c)	5	5	3(c)				
OR			OR			5	08
2(a)			4(a)	4	4		
2(b)			4(b)	5	4		
2(c)			4(c)	3	5	**Grand Total**	27

Signature of the Staff

[Q1]

(a) The properties of compressed air are :

→ Availability : Air is available literally everywhere in unlimited amounts.

→ Storage : Air can be stored in Reservoirs easily & utilised when required.

→ Transportation : Compressed air can be transported easily and utilised.

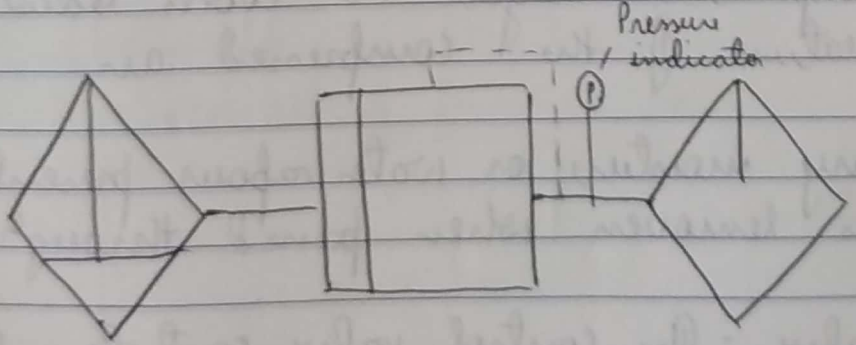
→ Temperature : Compressed air is insensitive to temperature fluctuations.

→ Explosion proof : Compressed air is explosive proof & environment friendly & can be used in all industries.

→ Cleanliness : Filtered compressed air is clean.

[Q1]

(b)



Air Filter Presure Regulator Lubricator

Air has to be compressed & processed and has to go through the filter, pressure regulator & the lubricator. This will be done by individual components. Aggregating all the processes into one single unit is known as Service unit. All the processes take place at once rather than passing through each of the filter, Regulator and the lubricator.

[Q1]

(c) The components of Pneumatic System are :

→ Air filter : The filter removes the suspended particles & cleans the air for further use.

→ Compressor : Air is compressed using a compressor. Depending on the need, the capacity of the compressor is chooser.

→ Cooler : The air after being compressed will be at a higher temperature. Therfore the cooler reduces the temperature of the compressed air.

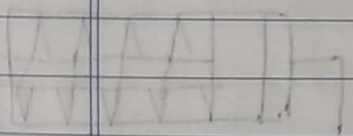
→ Dryer : Any moisture or water vapour present in the air is removed when passed through the dryer.

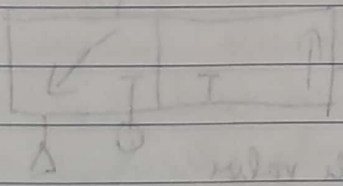
→ Control valve : The control valve controles, regulates and monitors the flow of the air.

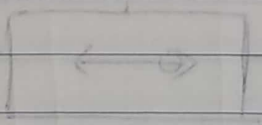
→ Air actuator :- The compressed air actuates the movement of the mechanical elements present in the system.

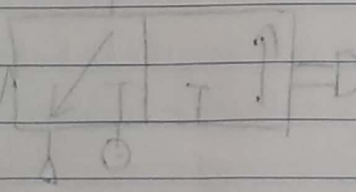
→ Electric Motor :- The electric motor converts the electrical energy into mechanical energy.

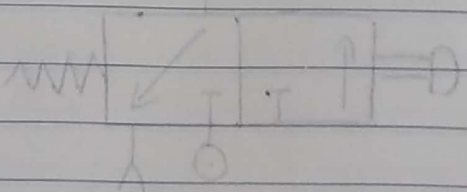
→ Reserve tank :- The air after passing through the compressor gets collected in the Reserve tank.







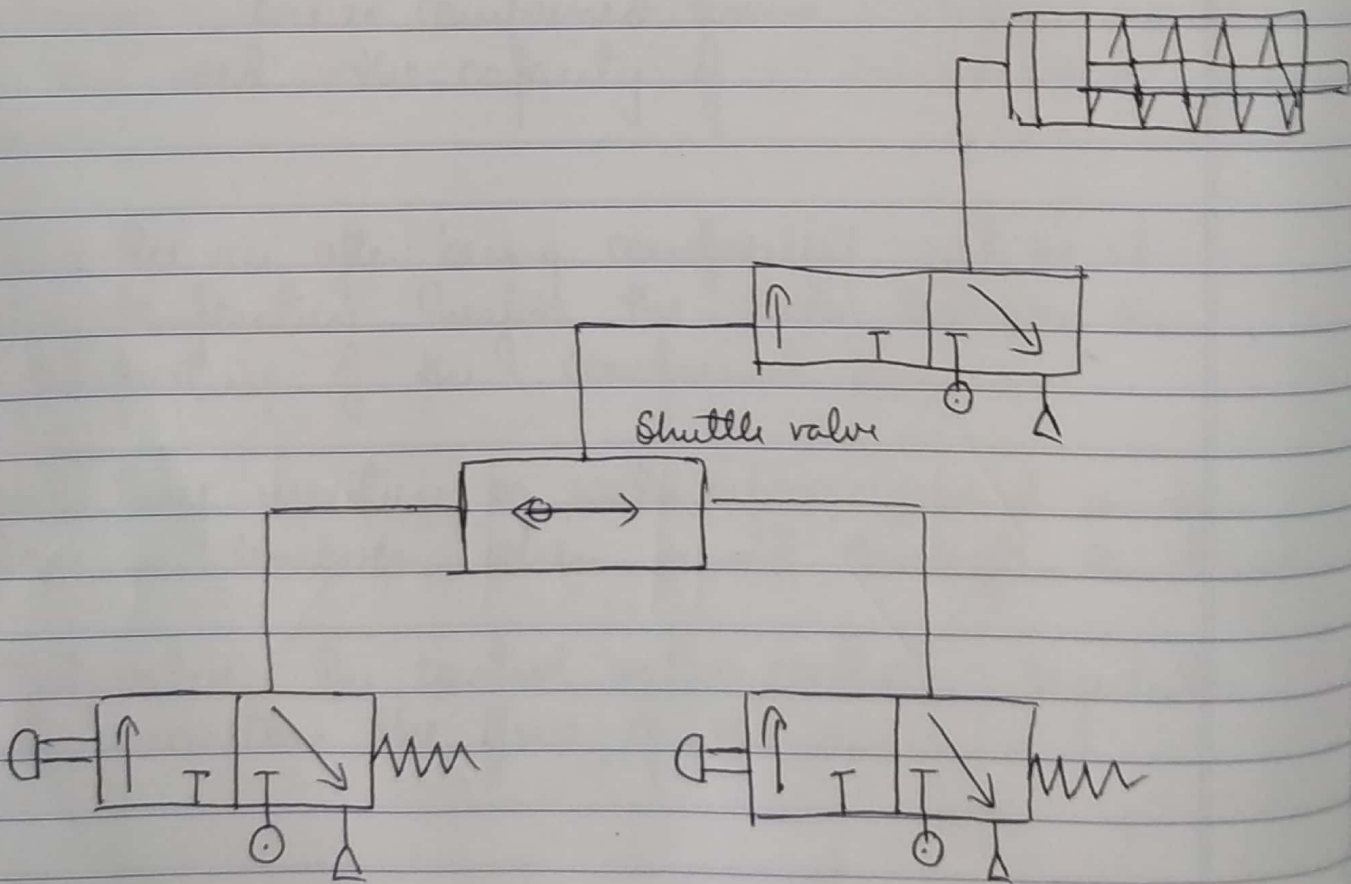


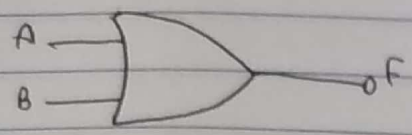


Q4(a)

Pneumatic circuit	Electro Pneumatic Circuit
→ This does not utilise any electrical components.	→ This utilises electrical solenoid valves.
→ The pneumatic circuit is drawn as a single circuit.	→ This is divided into two parts, namely: pneumatics & electrical components.
→ This uses compressed air for actuation of main control valve.	→ This uses electrical energy to actuate the main control valve.

Q4(b)





OR Gate

Input		Output
A	B	F
0	0	0
0	1	1
1	0	1
1	1	1

5

→ The OR gate has two inputs and a single output.
→ If the inputs are zero, the output will also be zero.
→ If one input is given & the other is zero, the output will be one, or the output will be produced.
→ If both the inputs are given, the output will be produced, or the cylinder actuation takes place.

Q4(c) Cascading is the method to eliminate the maintained & trimmed signals.

Principle of Cascading

→ Divide the circuit into groups.
→ Use a simple design technique to determine the minimum number of groups.
3→ Provide a bus bar signal to all the groups.
→ Provide a singnal element to the individually active groups.

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Dept. of Mechanical Engineering KSSEM

BLUE BOOK

Name of the Student: SHRIKAR. S

Class / Sem : VII SEMESTER Branch: MECHANICAL

USN : 1 K G 1 7 M E 0 3 5

SUBJECT : CE Subject Code :

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date			06/01/2021	30+10 (40)
Marks Obtained				
Signature of the Student			Shrikar	Shrikar
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY : VIJAYCHANDAN

SIGNATURE : vijchd

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			**Grand Total**	

Signature of the Staff

Q2(a)

$$G(s) = \frac{2}{s(s+1)(0.2s+1)}$$

In place of s replace with jw

$$G(jw) = \frac{2 + j0}{jw(jw+1)(1+0.2jw)}$$

Now, phase angle

$$\phi = \frac{\tan^{-1}\left(\frac{0}{2}\right)}{\tan^{-1}\left[\frac{w}{0}\right] + \tan^{-1}\left[\frac{w}{1}\right] + \tan^{-1}\left[\frac{0.2w}{1}\right]}$$

$$\phi = \tan^{-1}0 - \tan^{-1}\left[\frac{w}{0}\right] - \tan^{-1}[w] - \tan^{-1}[0.2w]$$

$$\phi = 0 - 90^\circ - \tan^{-1}[w] - \tan^{-1}[0.2w]$$

Frequency in Rad/sec	Phase angle in degrees
0.1	-96.85
0.2	-103.60
0.3	-110.13
0.4	-116.37
0.5	-122.27
1	-146.30
2	-175.23
3	-192,52
4	-204.62
5	-213.69

10	-237.72
20	-253.10
30	-258.62
40	-261.44
50	-263.14
∞	

Factor	Corner frequency rad/sec	Slope	Resultant db/dec
2	None	$20 \log_{10} K = 6$ db	-
$(1/s)$	None	-20 dB/dec	-20
$(1/s+1)$	1 rad/sec	-20 dB/dec	-40
$(1/0.2s+1)$	5 rad/sec	-20 dB/dec	-60

Q2(b) GCF = 1.6 rad/sec
PCF = 2.5 rad/sec

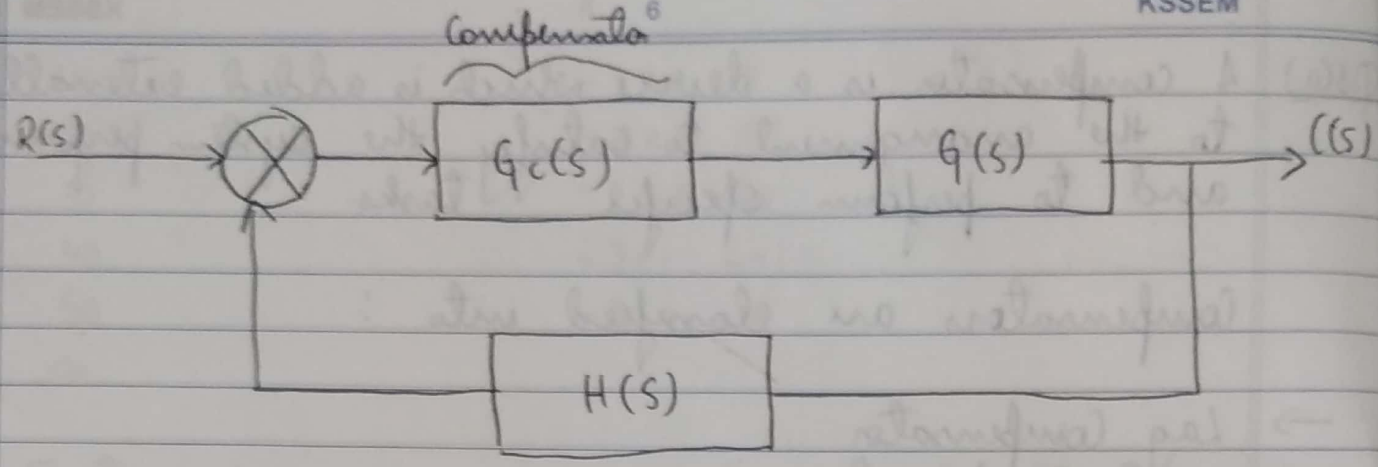
Q2(c) GM = 12 dB/dec
PM = 24°

Q3(a) A compensator is a device which is added externally to the arrangement to satisfy the system performance and to perform specific tasks.

Compensators are classified into :

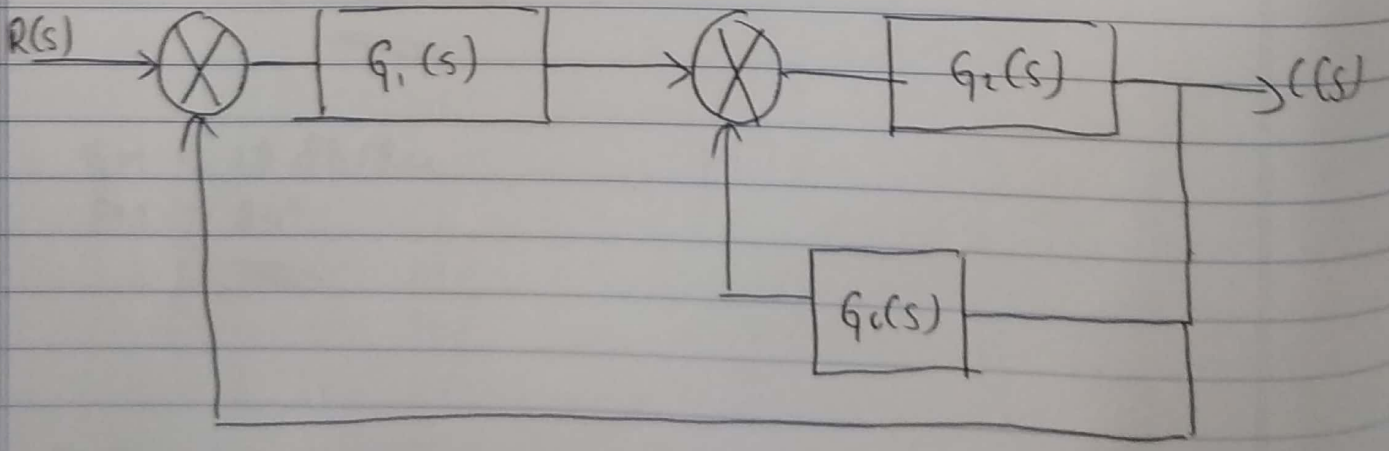
→ Lag Compensator
→ Lead Compensator
→ Lag-Lead Compensator

Q3(b)



The above figure shows the block diagram of a series compensator.
In this an external device known as a compensator which has a feedback system is introduced in series with the forward feedback system.
This is known as series compensator. This is also known as cascade compensator. In this arrangement the signal flows from lower energy to higher energy. Therefore an external device such as an amplifier is used.
Hence there are more number of components used in series compensator

Q3(c)



The above figures shows the block diagram of a parallel compensated system.
In this an external device known as a compensator which has a feedback system is introduced as a feedback to the circuit. This is also known as feedback compensation.
In this arrangement the signal flows from higher energy to lower energy. Therefore no external devices like amplifiers are required.

my pic

30/30

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BLUE BOOK

Name of the Student: SHRIKAR S

Class / Sem : VII SEMESTER Branch: MECHANICAL

USN : 1 K G 1 7 M E 0 3 5

SUBJECT : TRIBOLOGY Subject Code : 17ME742

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date			07/01/2021	30+10 (40)
Marks Obtained	30	30	~~35~~ 30	
Signature of the Student			Shrikar	Shrikar
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY :

SIGNATURE :

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5	CO4	3(a)	5	CO4	CO4	15
1(b)	5	CO4	3(b)	5	CO4		
1(c)	5	CO5	3(c)	5	CO5	CO5	15
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	30

Signature of the Staff

Q1(a) Dry friction is also known as solid state friction & it means that there is no coherant liquid or gas lubricant present between two solid surface. Therfor many theories have been given on dry friction & some of them are :

→ Theory by Leonardo Da Vinci : The elements of same weight will have equal friction at the beginning of movement, even though the lengths and breadths of the elements are different

→ Theory by G. Antonos : Friction is independent of the area of contact between two surfaces. Friction is directly proportional to the normal application of load. He said that friction depends on the angle of application of load on the surface.

The test measures are :

→ Spring balance : A spring balance connected to a block & when the force is increased on the block, the block starts sliding. The reading in the balance when the block starts sliding measures the static friction & the reading when the block continues to slide measures the dynamic friction

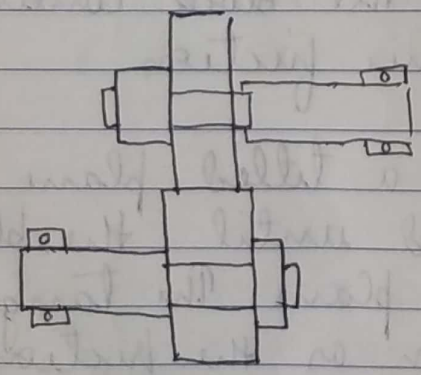
→ Tilt Level : A block is placed on a titled plane & the angle of titt is increased until the block starts sliding down on the plane. The tangent of the angle produced is known as the friction angle.

Q1(b) The mechanism of wear is classified as:

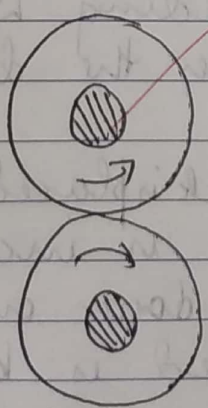
→ Adhesive wear
→ Abrasive wear
→ Cavitation
→ Corrosive wear
→ Erosive wear
→ Frictional wear
→ Fretting

The method of testing is:

→ Sliding rolling wear testing: The sliding rolling wear tester is one the most popular tribometer to investigate wear and frictional properties of materials under the condition of rolling, sliding or a combination of both rolling & sliding. Two rollers connected to two parallel shafts are pressed together to have a contact. Using an electric motor & a gear train, the rollers are rotated along with the shaft and the wear is noted down.



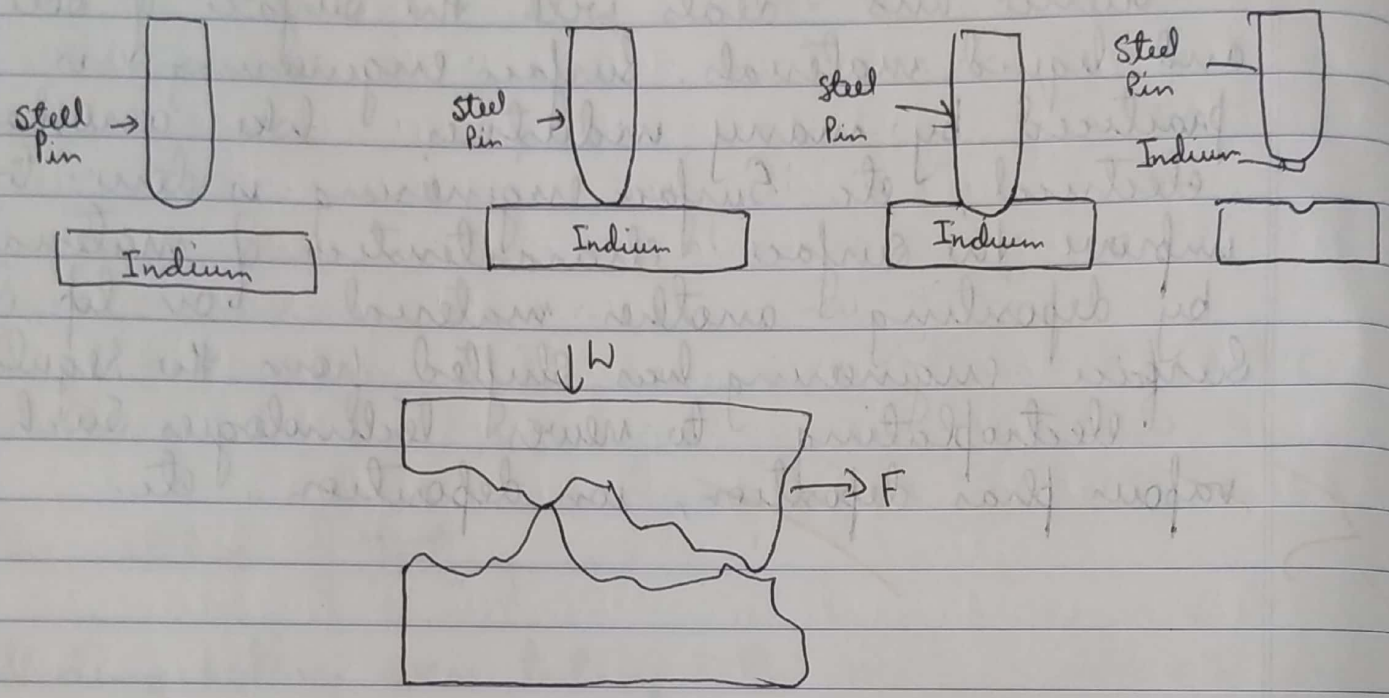
Roller on roller



Roller on bar

Q1(c) Surface engineering is a sub domain of material science and deals with the surface of solid and liquid materials. Surface engineering is practiced by many industries like, aerospace, electrical, etc. Surface engineering is done to improve the surface characteristics of materials by depositing another material on top of it. Surface engineering has shifted from the regular electroplating to newer technologies such as vapour phase deposition, ion deposition, etc.

Q3(a) Adhesive wear



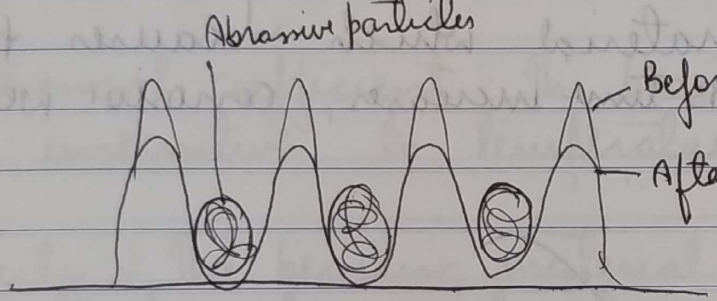
Adhesive wear.

Adhesive wear is the removal of material from a surface by another material on application of load. Let us take the example of Indium & steel pin. When the steel pin applies load on the indium and after the load is removed, ~~the indium~~. some part of the indium metal is removed and gets stuck to the steel pin. This happens due to strong adhesive force between the two metals.

Abrasive wear

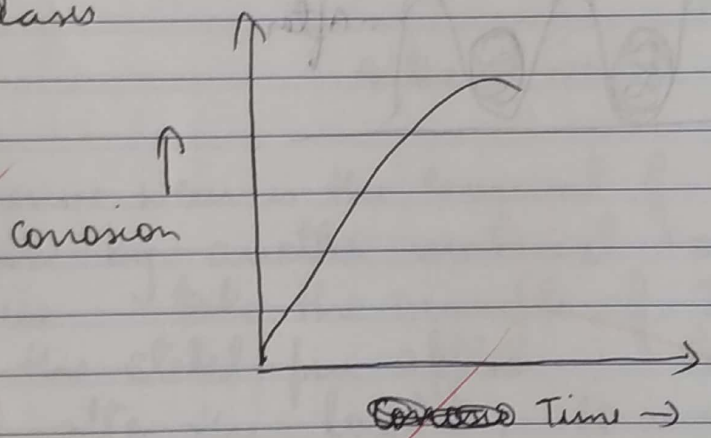
Abrasive wear is the removal of material by hard particles which slide or roll over the surface.
Scratching is also a type of abrasive wear.
When hard particles slide or roll over softer material, it removes the surface material.
There are two types of abrasive wear:

→ Two body abrasive wear
→ Three body abrasive wear.



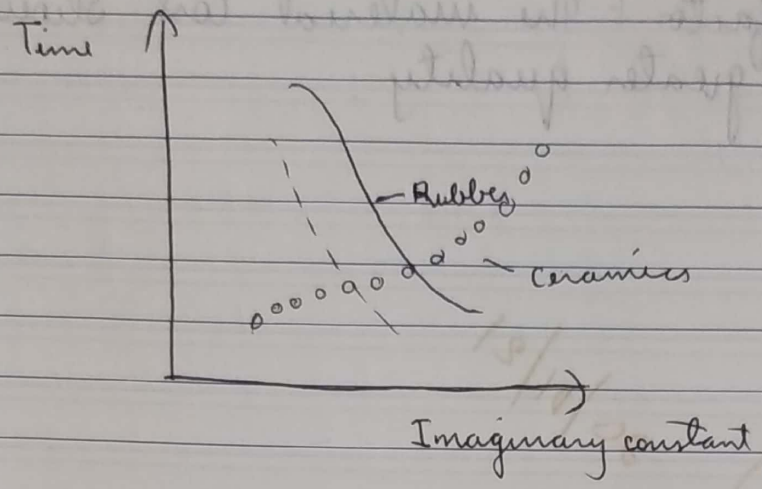
Q3(b) Corrosive Wear

Corrosive wear occurs due to chemical reaction & mechanical action on the surface of a material. One is the material and the other is the corrosive agent, like moisture or chemical reactant which causes the corrosive wear.
When the chemical reaction occurs and oxidation takes places on the surface of the material, the mechanical action like sliding or rolling removes the surface material which causes the degradation. As time increases, corrosive wear also increases



Erosive Wear

Erosive wear is the removal of material by impinging particles on the surface.
When water flows continuously on rocks, the particles present in water impinge on the rock and removes the surface & therfore wear occurs.



Q3(c) The properties are :-

→ High thermal coefficient : The bearing material should be insensitive to temperature changes.

→ Elasticity : The bearing material should be elastic and should return to its original state after the load has been removed.

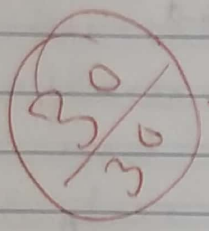
→ Low coefficient of friction : The bearing materials should have low coefficient of friction when two surfaces are in contact. This increases the life of the bearing.

→ Non corrosive : The bearing material should be corrosion resistant & should not react to the lubricants used.

→ Availability : The materials should be readily available in plentily & should be available even for replacement & repair.

Economic factor : The material cost should be minimized with greater quality.

30/01/21



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BLUE BOOK

Name of the Student: SHRIKAR.S

Class / Sem : VII SEMESTER Branch: MECHANICAL

USN : 1 K 6 1 7 M E 0 3 5

SUBJECT : MECHATRONICS Subject Code : 17ME753

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date			08/01/2021	36/40
Marks Obtained	27/30	30/30	22/30	
Signature of the Student			Shrikar.S	Shrikar.S
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY : Dr. J. Prashanth

SIGNATURE :

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)				
1(b)			3(b)				
1(c)			3(c)				
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	-5-	-4-	3(a)	-3-	-4-	-4-	-14-
1(b)	-3-	-4-	3(b)	-3-	-4-		
1(c)	-4-	-5-	3(c)	-4-	-5-		-8-
OR			OR				
2(a)			4(a)				
2(b)			4(b)				
2(c)			4(c)			Grand Total	22/30

Signature of the Staff

Q1(a) Microprocessors have evolved over the years drastically

4-bit microprocessor :- Intel in 1971 released the 4 bit microprocessor, 4004. It had a clock speed of 108 KHz.

8-bit microprocessor :- Intel in 1972 released the first 8-bit microprocessor, 8008. It had a clock speed of 216 KHz

16-bit microprocessor :- Intel in 1978, released the 16 bit microprocessor, 8036. It had a clock speed of 5 MHz and it consisted of 29,000 transistors.

32-bit microprocessor :- Intel in 1985, released the 32 bit microprocessor. It had a clock speed of 160 MHz and it consisted of 2,75,000 transistor.

64-bit microprocessors :- In the early 2000's the 64bit architecture came into existence. In 20003 AMD released their 64 bit microprocessor followed by intel.

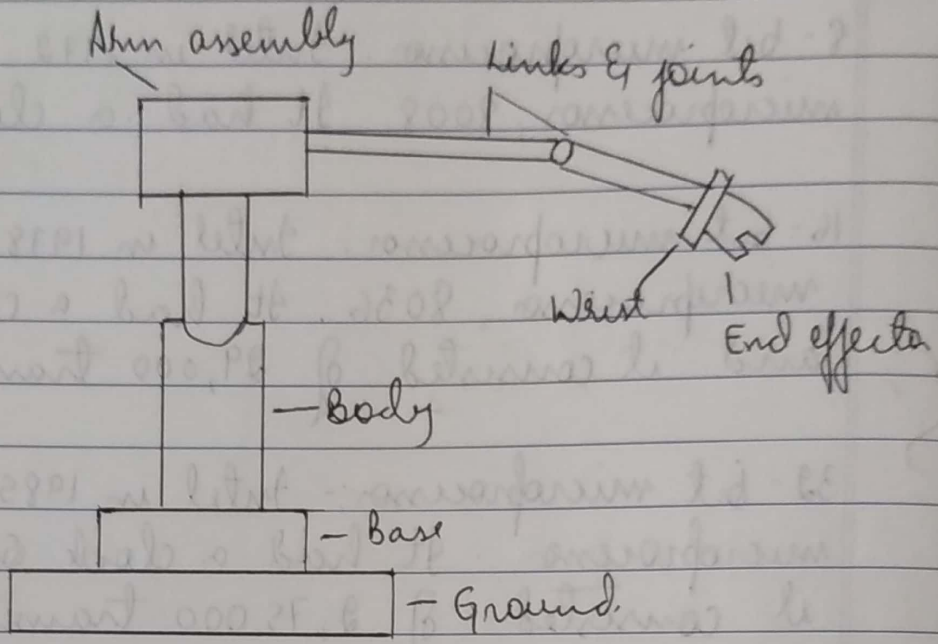
Q1(b) The basic elements of control system are :-

→ Program counter :- This holds the address of the information to be executed and all the other instructions are stored in the memory address.

→ Information register :- As the name suggests, it holds the information that is to be executed & is also known as current information register.

→ Status register: In the Status register, every bit represents different flag value which is either zero or one. This is used to give out the result.

Q1(c)



Usually the robots used in industries are mounted on the ground with the help of a base.
The robot has an arm assembly which consists of links & joints.
The joints help in the effective movement of the robot.
The end of the arm assembly has the wrist which is also known as manipulator.
At the end of the wrist is the hand which is also known as the end effector.

Q3(a) Assembler : Assembler is the one which converts the assembly level language into machin language. The assembler which is used in the microcontroller itself is known as the self assembler. The assembler which is used in the computer other than that which is used to execute object code is known as the cross assembler.

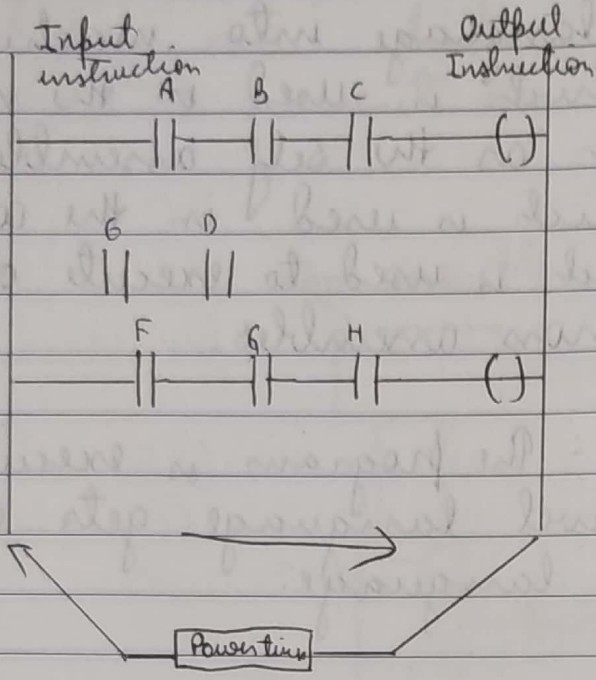
Instruction cycle : The program is executed when the assembly level language gets converted into machine language.

Q3(b) Bus : It is the combination of wires and connections which is used to transfer data from the microprocessor computer to the memory. It acts as a ~~transfer~~ intermediate medium to transfer the data and signals between the important parts of the computer system.

The types of buses are :

→ Address bus
→ Data bus
→ Control bus

Q3(c)



There is one vertical line on the left and two horizontal lines branch out from it towards the right
The signal always flows from left to right
The vertical line is known as the bus bar.

Graded
9/1/21

22/25

37

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Dept. of Mechanical Engineering KSSEM

BLUE BOOK

Name of the Student: SHRIKAR. S

Class / Sem : VII SEMESTER **Branch:** MECHANICAL

USN :

1	K	9	1	7	M	E	0	3	5

SUBJECT : ENERGY ENGINEERING **Subject Code :** 17 ME 71

MAXIMUM MARKS :

Test	I	II	III	Average Marks Obtained
Date	04/01/2021		04/01/2021	27 + 10 = 37
Marks Obtained	30	30	~~30~~ 20	
Signature of the Student	Shrikar S		Shrikar S	Shrikar S
Initials of Room Supervisor				
Initials of Faculty				

NAME OF FACULTY : PRABHU KS

SIGNATURE :

SIGNATURE OF H.O.D.

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First Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)			3(a)	05			
1(b)			3(b)	05			
1(c)			3(c)	05			
OR			OR				
2(a)	05		4(a)	0			
2(b)	05		4(b)				
2(c)	05		4(c)			**Grand Total**	30

Second Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	05		3(a)				
1(b)	05		3(b)				
1(c)	05		3(c)				
OR			OR				
2(a)			4(a)	05			
2(b)			4(b)	05			
2(c)			4(c)	05		**Grand Total**	30

Third Internal test

Q. No	Marks	CO	Q. No	Marks	CO	CO	Total
1(a)	5		3(a)			CO4	05
1(b)	5		3(b)				
1(c)			3(c)			CO5	05
OR			OR				
2(a)			4(a)				
2(b)			4(b)	5			20
2(c)			4(c)	5		**Grand Total**	20

Signature of the Staff

III INTERNAL

Q1(a) Given, $V = 15 m/s$

$T = 15^\circ C$

$D = 115 m$

Speed = 40 Rpm

Density of air, $\delta_{air} = \frac{P}{R \times T} = \frac{1.013 \times 100}{0.287 \times 288} = 1.2256 \ Kg/m^3$

Power density $= \frac{P}{A} = \frac{1}{2} \delta_{air} V^3 = \frac{1}{2} \times 15^3 \times 1.2256$

$= 2068.1348 \ W/m^2$

Max power density $= \frac{P_{max}}{A} = \frac{8}{27} \times \delta_{air} \times A \times V^3$

$= \frac{8}{27} \times 1 \times 15^3 \times 1.2256$

$= 1225.6 \ W/m^2$

Obtainable power density $= \eta \times \frac{P}{A} = 0.35 \times$

$= 723.847 \ W/m^2$

Total Power = Power density × A

$= 723.847 \times \frac{\pi}{4} \times 115^2$

$= 7518521.55$ W

Q1(b) Advantages

→ It is a non polluting source of power generation.
→ It is naturally occuring & no infrastructure is required.
→ No harm is done to the marine life.
→ No waste is generated which would affect the marine life.
→ There is optimum power generated during high tides.

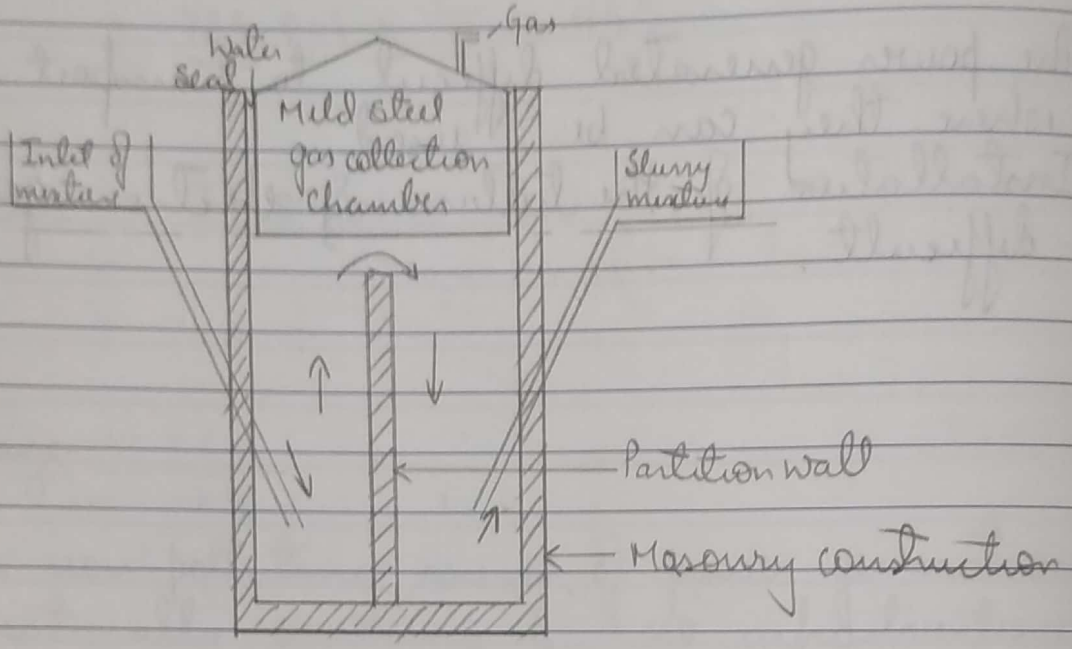
Disadvantages

→ Power generation occurs only when there is high tide.
→ This depends on the lunar activity, as tides are caused due to lunar activity.
→ The basin type location will not be available everywhere.
→ Transportation of the stored energy is difficult.

Limitations

→ The power generated difficult to transport to locations where they can be used.
→ Installation of the turbine & electric generator is difficult.

Q4(c)

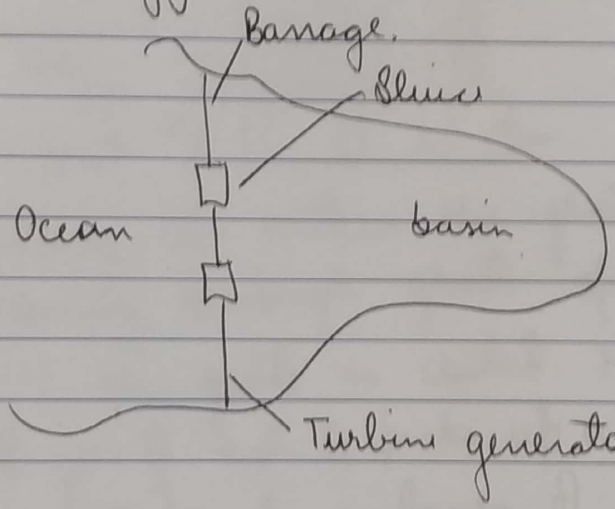


Khadi Village Industries Commission

Various types of ~~KVIC~~ digester plants are used around the world. The Khadi Village Industries Commission digester was designed in India & is being used This consists of a mild steel tank which works as a gas chamber. This is the most expensive part of the digester. The digester part is underground & it is a masonry construction which has a partition wall. The use of the partition wall helps in providing optimum conditions for the acidic & methane element. This KVIC digester works best when the ~~gas~~ gas element is in sufficient quantity.

Q4(b) Tidal energy is harnessed using either single basin system or double basin system.

The single basin system is the most basic & simple form of energy harnessing. The water fills the basin during flood tide & exits it during the ebb tide. When the water exits to the ocean during ebb tide the water goes through the turbine interm generating energy.



The double basin system has two basins and one turbine generator. The water fills one basin intermittently during the flood tide & empties the other basin during the ebb tide. This generates continuous energy although in small quantities. The main disadvantage of this system is that there is 50 % potential energy sacrifice due to the variation in water level between the in the two basins.