

Theory



# POORNIMA

## COLLEGE OF ENGINEERING

A/B. No. PCE/22/..... 38743

|                      |              |                         |                        |          |                           |
|----------------------|--------------|-------------------------|------------------------|----------|---------------------------|
| RTU Roll No..... N/A | Branch... IT | Year... I <sup>st</sup> | Sem... I <sup>st</sup> | Sec... F | Class Roll No... 22/F/063 |
|----------------------|--------------|-------------------------|------------------------|----------|---------------------------|

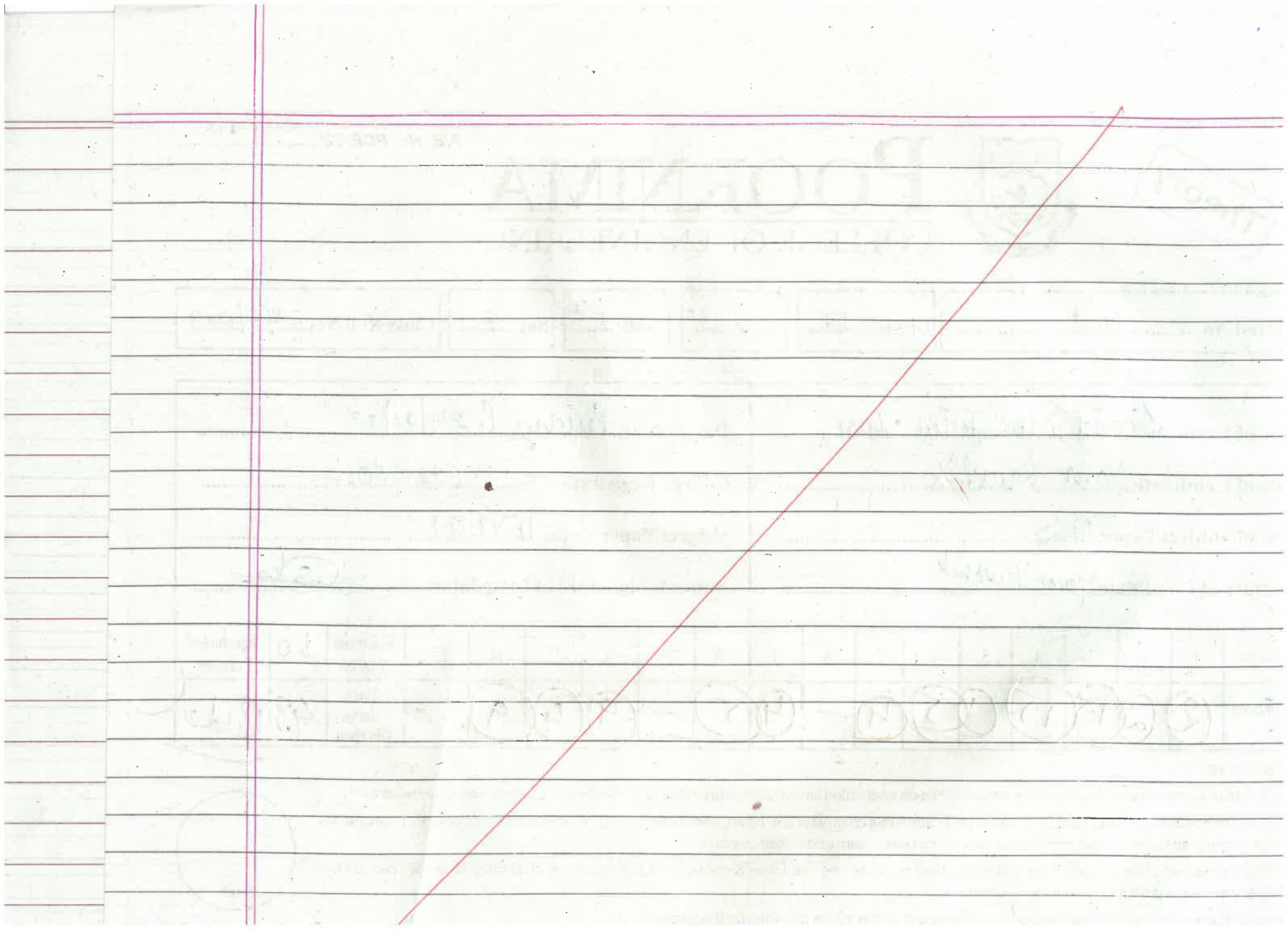
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|----------------------------------------|------------------------------------------------|
| Name of Exam... Second Mid-Term exam   | Day & Date... Friday 6 24/02/23                |
| Name of Candidate... Yana Kaushik      | College Registration No... PCE22IT062          |
| Name of Subject/Paper... BCE           | Subject/Paper Code... IFY3-09                  |
| Signature of Candidate... Yana Kaushik | Name & Signature of Invigilator... [Signature] |

| Question No.   | 1 | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks | 60 | Signature of Examiner |
|----------------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|---------------|----|-----------------------|
| Marks Obtained | 2 | 2 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15            | 48 | [Signature]           |

### INSTRUCTIONS :

- No Supplementary answer books will be issued. Write on each ruled line on both sides of the leaf. Please do not waste pages unnecessarily.
- Bringing cell phone / communication devices / programmable calculator (i.e. having memory capacity of more than six number) in exam hall is strictly prohibited Exam. Conducting authorities will not keep them under their custody.
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- Make all due entries on the cover page very carefully only at the space provided for the purpose.







## Part-A

Ans-1 A place where a group of plants, animals, human beings all live together is called Biodiversity. Biodiversity refers to everything in our surrounding living together. ~~all living beings and non-living beings comes under it. This is known as biodiversity.~~ 2

Ans-2 Ecosystem

It refers to everything in our surrounding, all abiotic and biotic things, living together in a system, known as ecosystem.

~~Living together and living in harmony with them, is ecosystem.~~

Ecology

The process of living together with everything in our surround-

Ans-3. Importance of transportation:-

- i) Development of social, commercial, and economical things.
- ii) It increases import and export.
- iii) It provides job and increase employment.
- iv) Development of rural areas.
- v) Development of society.
- vi) It makes work easy.

Ans-4. Food chain

The process of eating and eaten by someone is called food chain.

Plants  $\leftarrow$  Rabbit  $\leftarrow$  Lion  $\leftarrow$  Vulture

• Food Web

It is a web layer like structure in which human beings and animals fulfill their requirements by



Ans-5 Role of civil engineers in Transportation Engineering :-

- i) Civil engineers design ~~th.~~ and plan the infrastructure of buildings, dams, roads, bridges.
- ii) Civil engineers plays a major role in development of society.
- iii) Civil engineers provide employment to many workers.
- iv) Civil engineers works with balance of society and community.
- v) It looks after the budget, management and works on the project.
- vi) Civil engineers makes our surrounding unique with their special ideas.



## Part - B.

Ans-6 \* Various causes of accidents :-

- i) Drink and Drive
- ii) Not wearing helmets and seat belts while driving.
- iii) Using mobile phones, nowadays major cause of road accidents.
- iv) Fast driving and overtaking leads to cause road accidents many times.
- v) Avoid talking with anyone while driving.
- vi) Driving continuously for a long time cause laziness which leads to accidents.
- vii) Not following traffic rules, are the major cause of accidents.

\* Safety measures of accidents :-



- iii) Do not use mobile phones while driving.
- iv) Follow speed limit and do not overtake any other vehicle.
- v) Do not talk to anyone while driving, focus on only driving.
- vi) Take break while driving continuously or driving for more number of hours.
- vii) Follow all traffic rules and traffic lights.

These are the various causes and safety measure of accidents.

Ans-7 Greenhouse effect and global warming.

As we all know that pollution is the major cause of global warming. Humans are only responsible for it. As pollution increases, green house effect also increase which leads to depletion of ozone layer. It leads to



disease like skin cancer, skin burning etc.

14 All this leads to global warming. Increase in global warming leads to many harmful effects on humans. Pollution increases, global warming increases, if global warming increase it leads to melting of glaciers which lead to harmful for polar bears or many other species which are living there. If glaciers will melt, that water will cause more flow of water which will harm the plants of that area and it also cause tsunamis, which all leads to harmful for human beings.

Green house effect increases which leads to increase of harmful gases like chloroflouro carbon which is harmful for living beings.

Human beings are the main cause of harmfulness for themselves.



Ans-10. Traffic signs are the signs of traffic rules for the drivers.  
Traffic signs are important to follow.  
There are three types of traffic signs:-

- i) Warning signs
- ii) Regulatory signs
- iii) Informatory signs

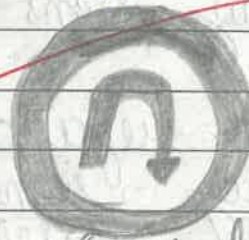
⇒ Warning signs are the signs <sup>which</sup> will ~~has~~ warn you about the hazardous and danger effect.  
Drivers should follow warning signs to avoid accidents



Stop

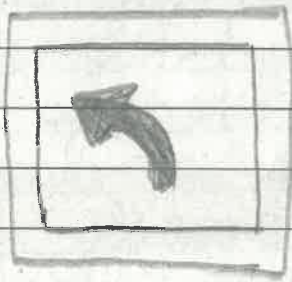


Speed limit

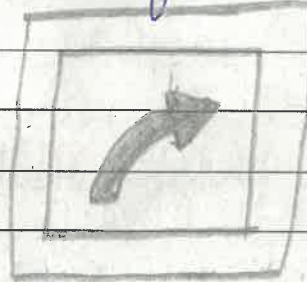


Compulsary U-turn

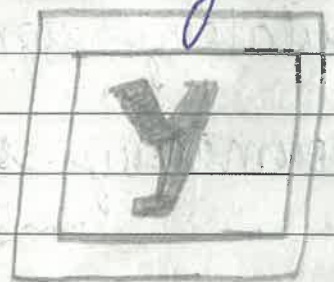
⇒ Regulatory signs ⇒ These are the signs which are of rules and regulations. These signs will tell about the rules and regulation which needs to follow while driving. All rules must be followed by driving.



Left turn



Right turn

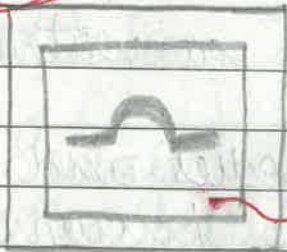


Y-junction

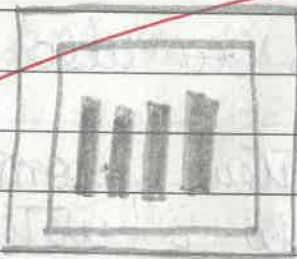
⇒ Informatory signs ⇒ These are the signs which will tell you and will give you information regarding signs. Informatory signs are useful for drivers while driving. They will be getting informations about all the signs which are important for them.



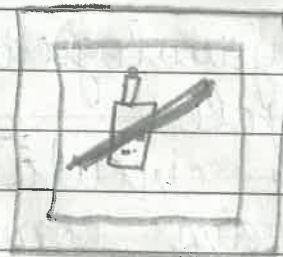
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Speed Breaker

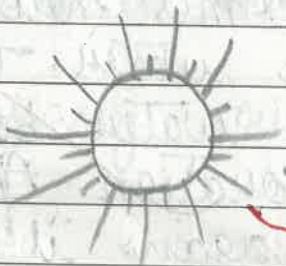


Zebra crossing

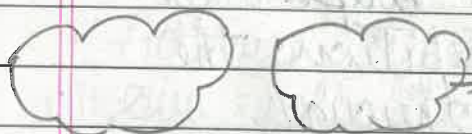


No phone use

Ans-9



sun



clouds



evaporation

rainfall



condensation

Reception

Hydrological cycle is also called as water cycle.

The circulation of water from water bodies and again comes back to water bodies is known as water cycle or hydrological cycle.

The water in water bodies comes through rainfall. Sun helps to evaporates the water. The process of evaporating the water from water bodies by heating is called ~~was~~ evaporation. After evaporation, the water condense. When again it evaporates. And then through the process of precipitation the water comes back to water bodies through rainfall.

Part-C

Ans-12 Air pollution. Causing damage to air by air



Pollution in air is known as air pollution.

### • Sources

- 1) Air pollution is caused by vehicles.
- 2) Air pollution is caused by factories.
- 3) Burning of plastics leads to air pollution.
- 4) Burning of coals causes air pollution.

There are many sources by which air pollution is caused.

### • Adverse effect

- 1) Air pollution cause many diseases like asthma, lung cancer etc, which is very harmful for human body.
- 2) Dangerous and harmful gases which is released by factories cause worst effect of human body which leads to death.

- Control Strategies

- 1) Less use of vehicles for short distance travels.
- 2) factories should use chimneys, so that it prevent air pollution.
- 3) Plastic should not be burned nor buried. Use of plastic should stop.

Ans-14 There are three modes of transportation :-

- 1) Roadways / Highways
- 2) Railways
- 2) Waterways
- 3) Airways.



But it takes more time. Road transportation is done in any rural and urban areas.

### ⇒ Railways - Railways.

Transportation which is done by rails & trains are known as rail transportation or railways.  
It is affordable, everyone can afford it.  
It is comfortable for travelling and all facilities are provided in train.

### ⇒ Waterways.

Transportation by water with the help of boats and ships is known as water transportation or waterways.  
It is the richest mode of transportation and it also takes more time.

### ⇒ Airways

transportation.

It is also very ~~exp~~ high prices and everyone can't afford it.

It takes less time

## \* Roadways

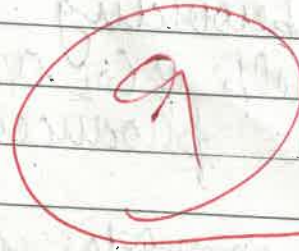
### Advantages

- i) Everyone can afford it.
- ii) Cheap in price.
- iii) It goes everywhere at every ~~village~~ and urban place.
- iv) It provides employment to many people.

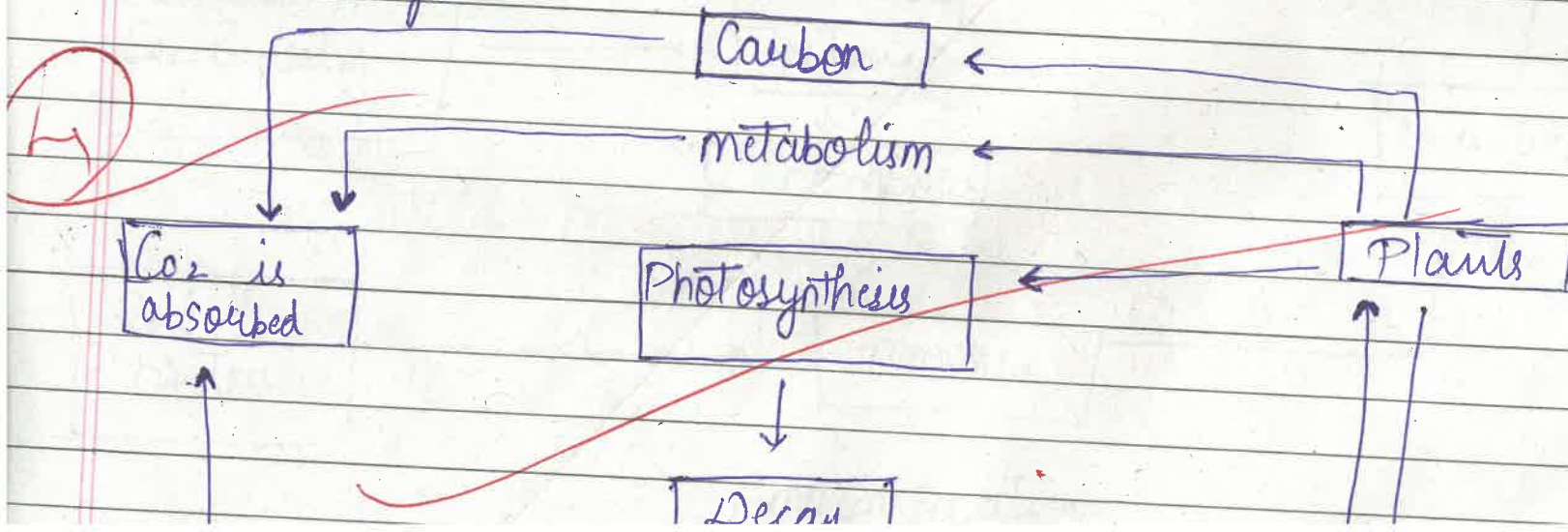


## Disadvantages

- 1) It takes more time
- 2) Travelling in bus is not easy.
- 3) Cannot travel for more hours.



## ns-13 Carbon Cycle

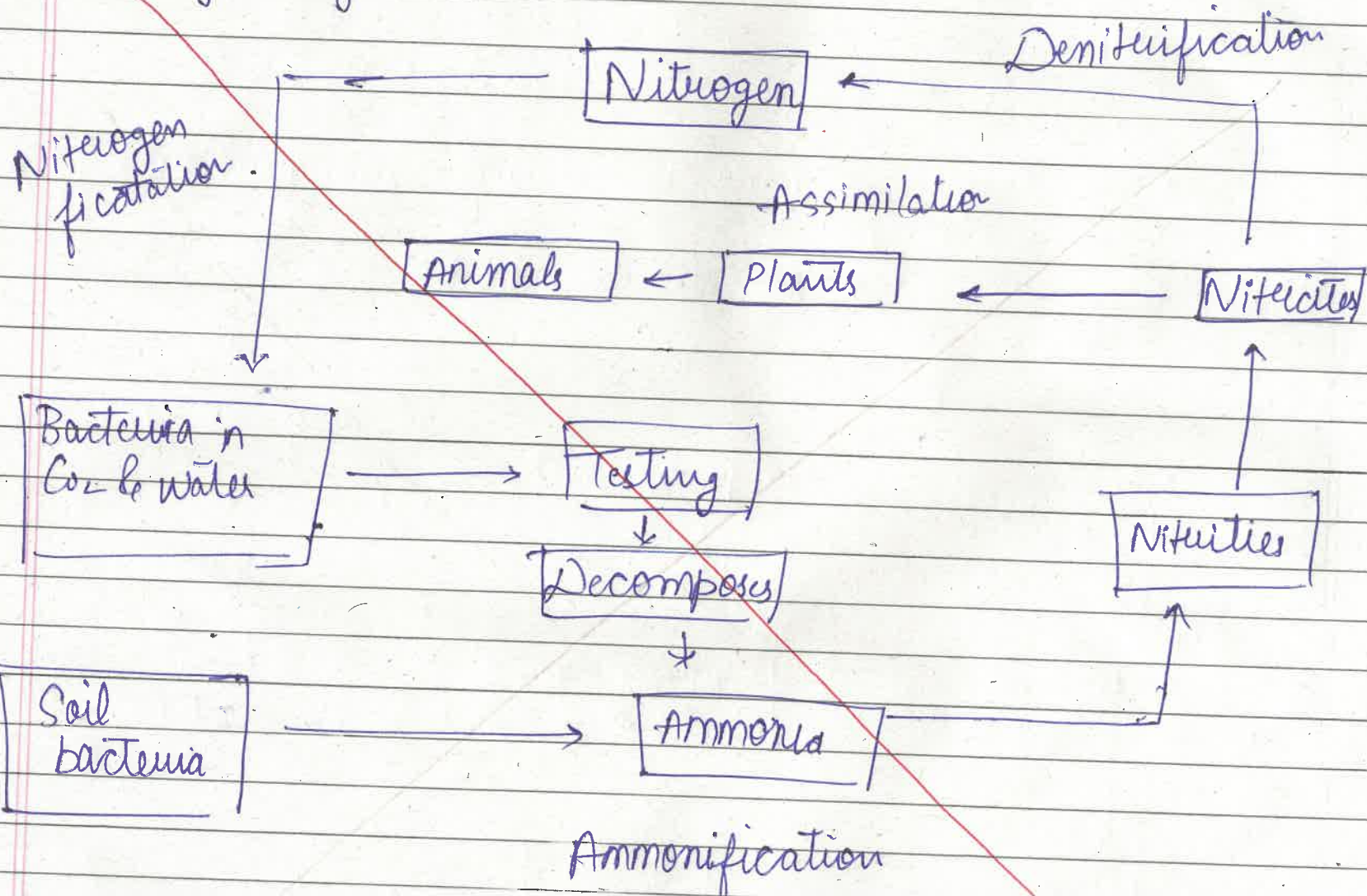


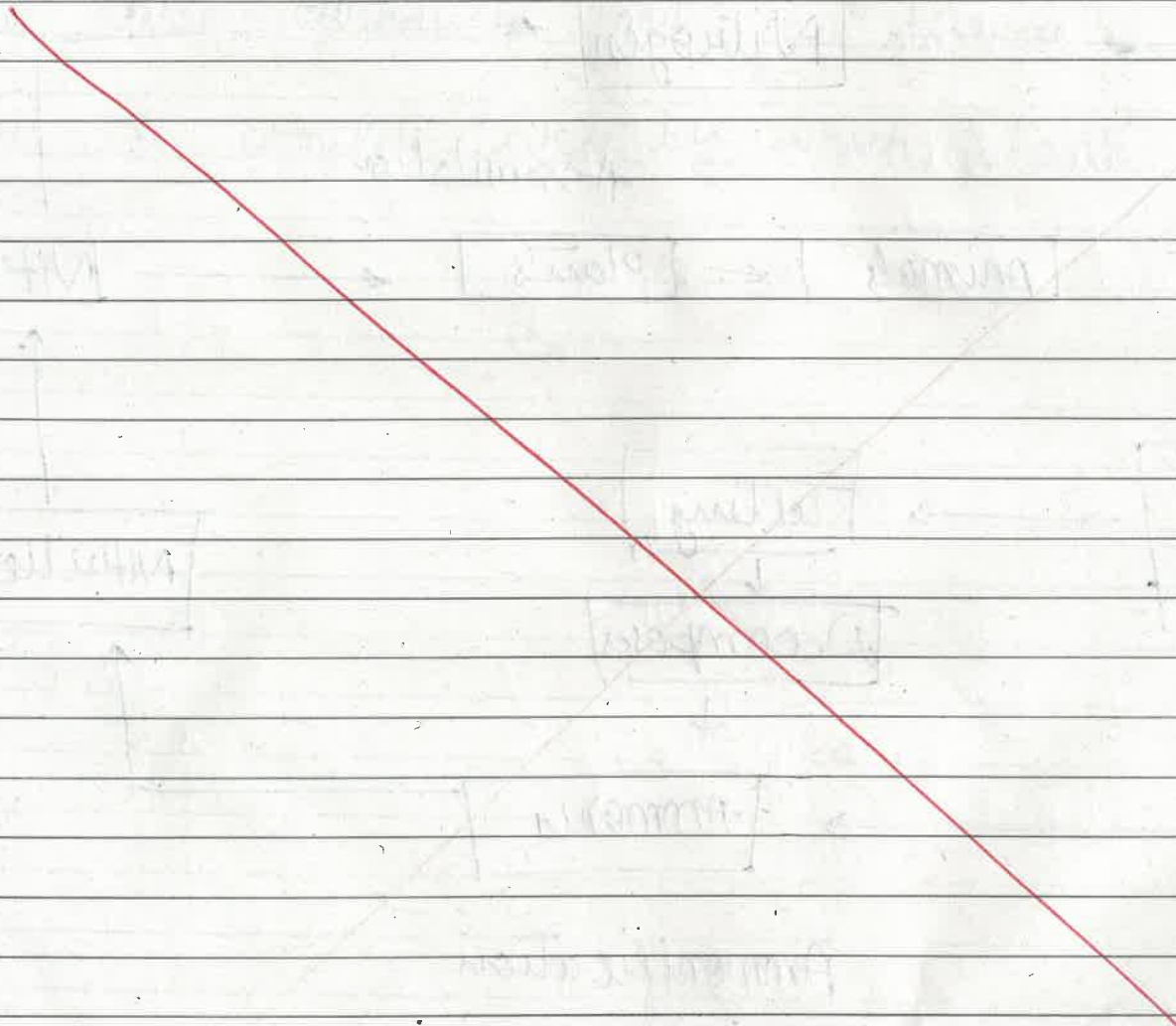
Carbon is provided by human or plants, make food with the help of  $\text{CO}_2$  and chlorophyll, water, sunlight like  $\text{CO}_2$  and produces food for humans.

This is complete cycle by which plants take  $\text{CO}_2$



## Nitrogen Cycle







**Theory**



# POORNIMA

## COLLEGE OF ENGINEERING

A/B. No. PCE/22/.....**45037**.....

|                                          |                              |                                       |                                      |                           |                                            |
|------------------------------------------|------------------------------|---------------------------------------|--------------------------------------|---------------------------|--------------------------------------------|
| RTU Roll No..... <u>19EPCCS124</u> ..... | Branch..... <u>CSE</u> ..... | Year..... <u>4<sup>th</sup></u> ..... | Sem..... <u>7<sup>th</sup></u> ..... | Sec..... <u>B-3</u> ..... | Class Roll No..... <u>19/CS-R/54</u> ..... |
|------------------------------------------|------------------------------|---------------------------------------|--------------------------------------|---------------------------|--------------------------------------------|

|                                                            |                                                               |
|------------------------------------------------------------|---------------------------------------------------------------|
| Name of Exam..... <u>Mid-Term-2 Theory</u> .....           | Day & Date..... <u>Monday 05/12/22</u> .....                  |
| Name of Candidate..... <u>Poorni Goyal</u> .....           | College Registration No..... <u>PCE19CS124</u> .....          |
| Name of Subject/Paper..... <u>Internet of Things</u> ..... | Subject/Paper Code..... <u>7CS4-01</u> .....                  |
| Signature of Candidate..... <u>[Signature]</u> .....       | Name & Signature of Invigilator..... <u>[Signature]</u> ..... |

| Question No.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11  | 12  | 13  | 14  | 15 | Maximum Marks        | Signature of Examiner |
|----------------|---|---|---|---|---|---|---|---|---|----|-----|-----|-----|-----|----|----------------------|-----------------------|
| Marks Obtained | 2 | 2 | 2 | 2 | 2 | 4 | / | 4 | 4 | /  | 4.5 | 0.5 | 8.5 | 8.5 | /  | 60                   | [Signature]           |
|                |   |   |   |   |   |   |   |   |   |    |     |     |     |     |    | Total Marks Obtained | 52                    |

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(Part-A)

Ans.1. The difference between M2M and IOT are:-

| <u>M2M</u>                                                        | <u>IOT</u>                                                                                                 |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| → Machine to machine communication happens and is hardware based. | → Machine to machine, machine to sensor, human to machine communication takes place and is software based. |
| → Doesn't rely on Internet                                        | → Rely on Internet.                                                                                        |
| → Data can be stored locally.                                     | → Data can be stored locally as well as on cloud.                                                          |
| → Uni-directional.                                                | → Bi-directional.                                                                                          |

Ans.2. The communication protocols which can be used for M2M local area networks are as follows:-

- Bluetooth



Ans. 3. The BigData is now-a-days a big concept in IT industry. Its importance is very crucial in IOT. The necessity of BigData in IOT can be explained as there are many data that get generated everyday because of IOT devices as they store and generate information of users at large scale. So its maintain and analyze such huge amount of data is hard. That's why BigData is important in IOT.

Ans. 4. There are many kind of IOT devices and one of them is ~~new~~ wearable IOT devices which can include, wrist bands, smart watch etc. These kind of wearable IOT devices are very useful as they have many advantages like easy to carry, portable, small in size, can detect any type of health symptom all the time etc. Because of these type of IOT devices, a user can monitor his/her health.

## (Part-B)

Ans. 9.

SDN:

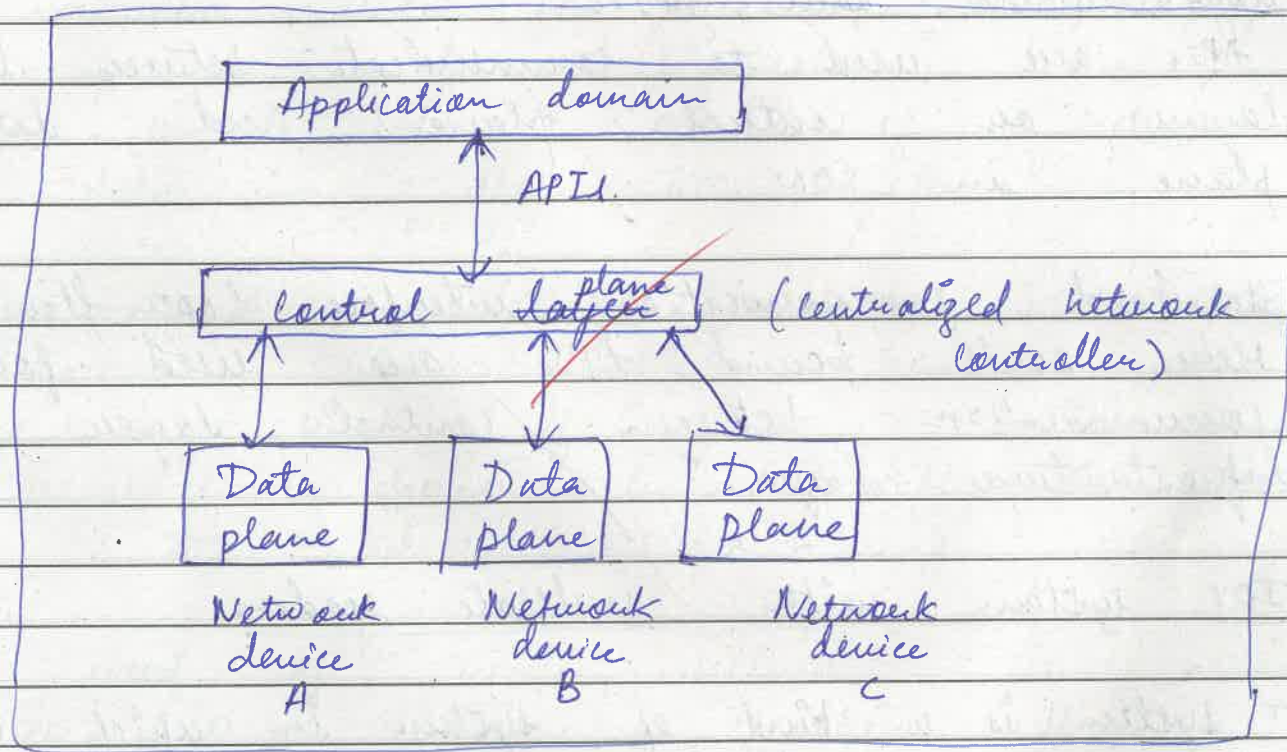
- It stands for Software defined networking.
- SDN is mainly a process that separates control plane and data plane and centralizes the network controller.

Basic concepts of SDN-

- Separate the control plane from hardware switches.
  - Define the control plane in centralized manner.
  - Control the entire network including individual switches.
  - The communication between control plane and application domain through or by using APIs.
- Here, ~~the~~ each data plane denotes the data of particular network device.



→ SDN architecture:-



→ Key elements in SDN:-

- 1) Centralized network controller - Separation of data and control plane help the network administrator to rapidly configure the entire system on network.

2) Programmable open APIs

APIs are used to communicate between the layers on control plane and data plane in SDN.

3) Standard communication interface (open flow).

Here, south bound APIs are used for communication between control layer and infrastructure layer.

Ans. 8. IOT system with multiple nodes.

→ IOT system is a kind of system in which many appliances or devices communicate with each other, pass information to each other and many things by using the medium which is Internet.



→ The network wide configuration is simply describing the process of configuration in a very large or wide area of network as its help in the IOT system.

→ The network wide configuration is important for IOT systems with multiple nodes as the all type or kind of IOT devices has unique IP which helps in differentiating <sup>what</sup> the kind of IOT devices is being use or used.

→ The need of wide network is because it covers large area rather than short or local area. The wide network can also be of at global level or for each continent, ~~can be~~ particular country, particular state or particular city.

→ One in common between the manufacturing of IOT

→ The network wide configuration is a kind of configuration that can also help in determining how many IOT devices or systems are present and how much are currently in use among them.

→ That can help in maintaining its performance, efficiency and can also manage or state of manufacturing of IOT devices or IOT system.

Ans. 11.      NAF :

→ It stands for Network Function Virtualization.

→ NAF is the process in which it replaces the dedicated network appliances



→ NFV (Network Function Virtualization) provides an infrastructure on which SDN runs. Both SDN and NFV are beneficial to each other but are not dependent.

→ Key Elements used in NFV:-

1) Network Function Virtualization Infrastructure (NFVI):-

- It presents or includes hardware resources like computing resources, network and storage resources.

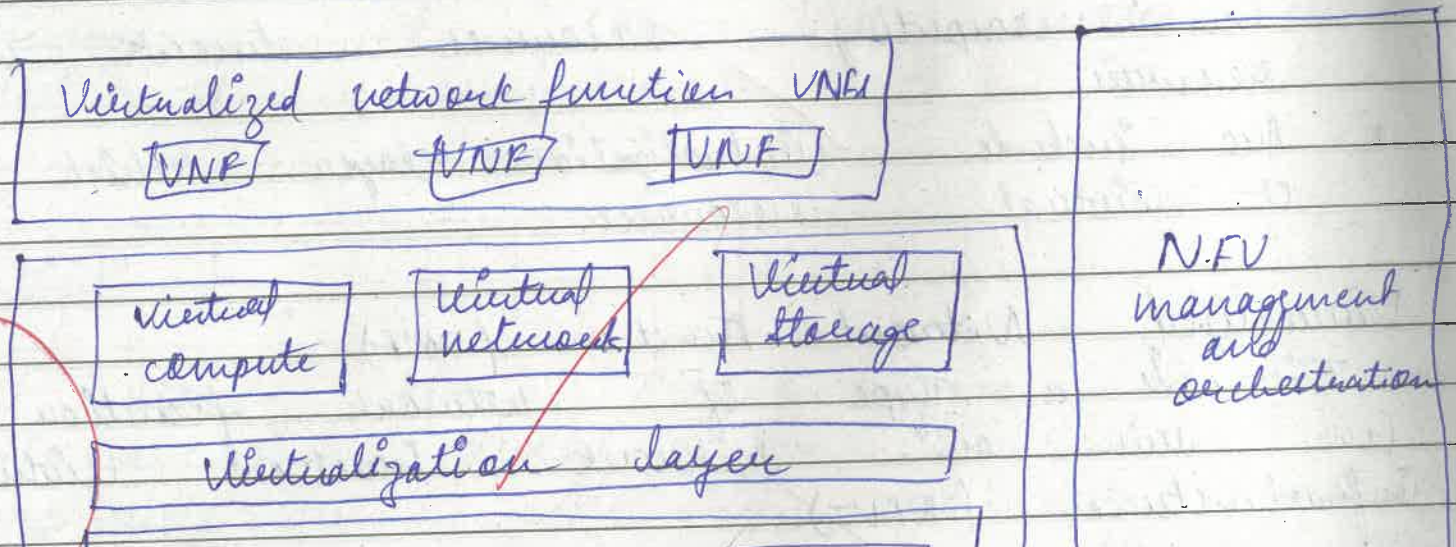
- Also include virtualization layer which consists of virtual resources.

2) Virtualized Network Function (VNF):-

This is a type of network function that can run on Network Function Virtualization Infrastructure (NFVI).

3) NFV management and orchestration:-

- Virtualization Infrastructure manager  
↳ manages hardware resources and virtual resources
- VNF manager  
↳ manages life cycle of VNF
- Orchestration  
↳ manages life cycle of network services.





Ans. 6.

### Air Pollution Monitoring System:-

- This type of monitoring system is related to the field of Environment.
- Air pollution monitoring system is the system which is used for detecting the how much polluted air is present in the atmosphere.
- Air pollution monitoring system is a very important and useful type of monitoring system as it helps in maintaining the percentage of toxic air in clean air in the atmosphere.
- By using the air pollution monitoring system, we can predict what steps to take to make air less polluted which

→ The type of sensor that is used in air pollution monitoring system is used to sense what kind of air molecules or toxic fumes are present in the atmosphere.

→ The sensor that are equipped with CO and  $\text{NO}_2$  which are basically poisonous air or gas are used in this monitoring system.

→ These type of sensor first sense if air is polluted or not, how much it is polluted, in what percentage or of what kind of gases or air is present and what counter measures to take to reduce the toxicity level ~~in~~ of the atmosphere, as to also reduce health



(Part-C)

Ans. 14.

NFV

- NFV stands for Network Function Virtualization.
- NFV is the process in which it replaces the dedicated network appliances or devices like routers, firewalls etc. with the software that can run on any general purpose central processing units or network operating or standard servers.
- NFV (Network Function Virtualization) provides an infrastructure on which SDN (Software Defined Network) runs. Both SDN and NFV are beneficial for each other but are not dependent on each other.
- Corporate IT acts as business initiator in ~~new~~ SDN

→ Key elements in NFV:-

1) Network Function Virtualization Infrastructure (NFVI):-

- It presents or includes hardware resources such as computing resources, network resources like routers and storage resources like hard disk.

- It also includes virtualization layer which consists various virtual resources like compute, network and storage.

2) Virtualized Network Function (VNF):-

- Virtualized Network Function is a type of network function that can run on



2) NFV management and orchestration:-

→ It includes three parts which are as follows:

- Virtualization infrastructure manager

- ↳ This manages hardware resources and virtual resources such as compute, network and storage and also manage the virtualization layer.

- VNF manager

- ↳ This manages the life cycle of VNF which basically runs on network function virtualization infrastructure.

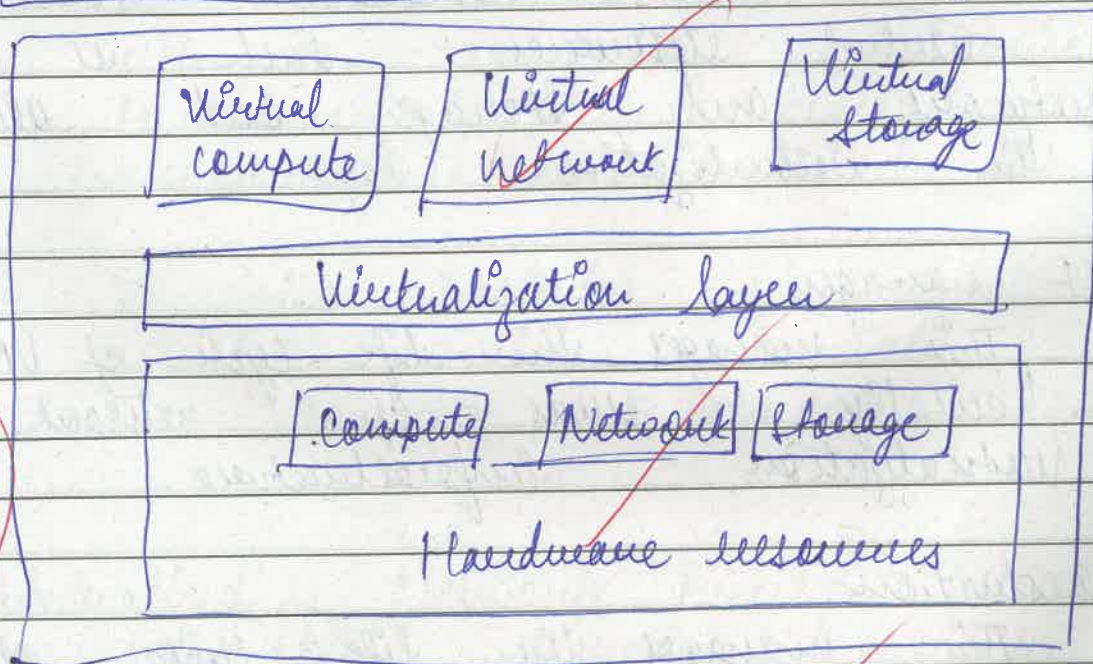
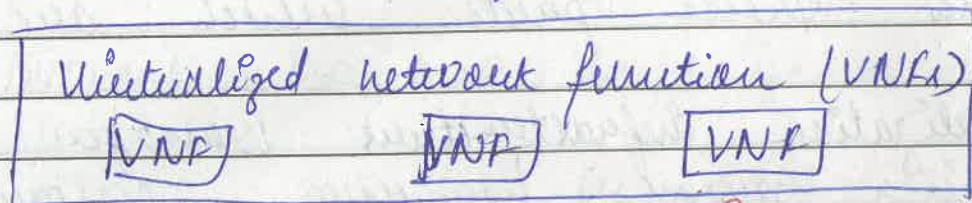
- Orchestration

- ↳ This manages the life cycle of network services which includes.

- Policy management
    - Performance



The architecture of NFV



NFV  
management  
and  
orchestration





Ans. 13.

## Health and Lifestyle Monitoring

⇒ For monitoring health and lifestyle of particular or individual user, different types of or kind of IOT devices are used.

⇒ These types of IOT devices usually ~~can~~ come under the category of wearable IOT devices.

⇒ These type of devices are wearable because any individual or particular person wants to check or monitor its health state at anytime or anywhere.

⇒ And because these type comes under the category of wearable IOT devices, they are easy to carry, ~~portable~~, small in size.

And for this purpose

⇒ The generation of data or data generation process happens when an individual or a particular user or person. Suppose we are wearing a fitness band to check how many steps he/she has taken today.

⇒ Then that IoT device send this generated data of that particular user or person to the network where data is stored.

⇒ Since this kind of data of different person and users are generated so to manage this, we use the concept of Big Data.

⇒ Big Data is useful in managing or processing all kinds of data and



⇒ Now after the generation of data, it moves further for processing or analyzing steps.

⇒ For the process of analyzing, the concept of data analysis is used.

⇒ Data analysis is the process of analyzing data and gives useful information according to it.

It can also be used for predicting future outcomes or results for a particular research.

⇒ So the data of the user which contains how many steps does the user taken goes for analysis then after process it will be can show results like how much more steps should the person take or many other suggestions to the user.

⇒ Through this types of monitoring devices, the user can also measure:

- Heart rate
- Water intake in a day
- Cholesterol level
- Sugar level
- Steps taken

and many other things.

Ans. 12.

Home Automation :

⇒ These types are kinds of IOT systems are used for many tasks which can include

- Smart lighting
- intrusion detection
- smoke / gas detector
- indoor air quality / detector



⇒ The system of home automation in IOT uses many kinds or types of sensors for different purposes.

⇒ In smart lighting system,

- This include the control over the lights of a particular house.
- This can include like on/off of switches, controlling the dimness of light etc.
- Through this, we can also (previously said or written instruction) change the colours of light.
- This kind of system can be done through phone or by using more different types of sensors.
- Suppose, if we walk in corridor then lights get on automatically by using pressure sensor.
- or the light gets on when we clap or trigger it

⇒ These kinds of systems also includes all the process of data generation, its processing, analyzing and giving results or outputs.

⇒ While in intrusion detection system,  
• This type of system is used for security reasons.

• As do make sure no unwanted person enters the house, this system is generated.

• This kind of system can work when nobody is present in the house, then we activate the system to detect any intruder.

• The detection of intruders can be done by pressure sensor or biometric sensor.

• If any abnormality gets detected then an message send to the owner.



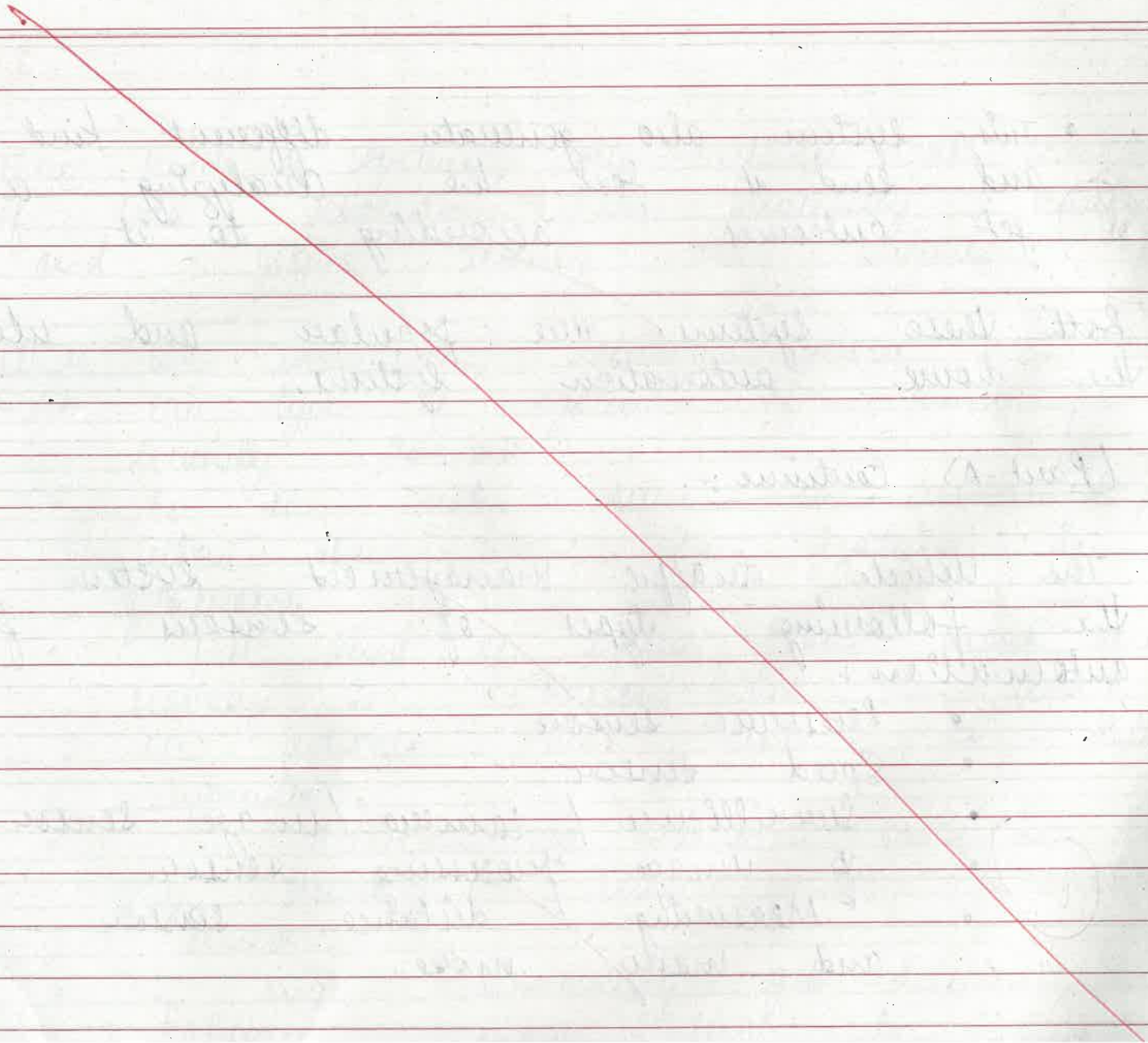
- 8.8
- This system also generates different kind of data and send it for the analyzing and get outcomes according to it.

⇒ Both these systems are popular and used in all the home automation systems.

(Part-A) Continue :-

Q.5. The Vehicle traffic management system used the following types of sensors for automation :-

- Pressure sensor
- Speed sensor
- Surveillance / camera / image sensor
- Image processing sensor
- Measuring distance sensor
- and many more.





14687

A/B. No. PCE/22/.....

Theory



# POORNIMA

## COLLEGE OF ENGINEERING

|                                |                   |                 |                  |               |                          |
|--------------------------------|-------------------|-----------------|------------------|---------------|--------------------------|
| RTU Roll No. <u>19EPCCS186</u> | Branch. <u>CS</u> | Year. <u>IV</u> | Sem. <u>VIII</u> | Sec. <u>C</u> | Class Roll No. <u>44</u> |
|--------------------------------|-------------------|-----------------|------------------|---------------|--------------------------|

|                                                   |                                                     |
|---------------------------------------------------|-----------------------------------------------------|
| Name of Exam. <u>Second Mid Term Exam 2022-23</u> | Day & Date. <u>Monday 19/06/2023</u>                |
| Name of Candidate. <u>Tarun Upadhyay</u>          | College Registration No. <u>PCE19CS182</u>          |
| Name of Subject/Paper. <u>Big Data Analytics</u>  | Subject/Paper Code. <u>8CS4-01</u>                  |
| Signature of Candidate. <u>Tarun</u>              | Name & Signature of Invigilator. <u>[Signature]</u> |

| Question No.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks        | Signature of Examiner |
|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------------------|-----------------------|
| Marks Obtained | 5 | 1 | 1 | 2 | 2 | 4 | — | 4 | 4 | 5  | 9  | 9  | 9  | —  | —  | 60                   | [Signature]           |
|                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    | Total Marks Obtained | 51                    |

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TO : DIRECTOR, FBI  
FROM : SAC, NEW YORK (100-100000)  
SUBJECT: [Illegible]  
RE: [Illegible]

100-100000-100  
JAN 10 1968  
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### Part-C

Q14. Writable wrapper class are use to wrap the existing Java primitives class to provide additional functionality to primitive class.

- This writable wrapper class provide two function to every class are set() and get(). Where set() is use to send or transfer the data and get() is use to retrieve the data.

⇒ All writable wrapper class for Java primitives are :-

- 1) Text
- 2) Binary
- 3) Null
- 4) Object
- 5) ~~Generic~~ Generic

## 4) Text:-

- This class is use to process the text or string data types
- This class use different operation to process the text are:-

- a) Indexing
- b) Iteration
- c) ~~Iteration~~ Mutability

### (a) Indexing:-

- This operation is use to change the any character of text using its index.
- For this operation we use `charAt()` function -  
`charAt()` function return the index value of character in the text



### (b) Iteration :-

- This operation is used for implementing loop over a text. Loop can be performed using for, while, do-while loop.
- In this operation we can perform any operation on text using looping.

### (c) Mutability :-

- This operation is used to perform mutability operation in which can easily change any character or series of character in text.
- Mutable justifies that we can make changes on text and we can change any character many times as we want.

## 2) Binary:-

- This class is used to process binary valued array like 10101001
- In this class first value is convert into Hexa Code then it process as binary valued array
- Ex - Two element 2, 8  
00000002    00000008  
                  ↙↘  
00000028

## 3) Null class:-

- In this class no value is stored.
- This class equiped space for future use.



#### 4) Object :-

- When we have to use text, number, boolean in a same class so we use object class.
- Object class contain all the data type like Byte Writable, Short Writable, int Writable, long Writable, float Writable.
- In this class all the data types are processed at on single time.

#### 5) Generic Object :-

- This class contain all the functionality of object class.
- But Generic class is more faster and ~~the~~ efficient than object class because object class override the base class but Generic class don't override the base class.

Q13

1) Error handling in Pig :-

- Error handling in Pig is done using parser
- Parser is used to check the syntactically and grammatical error in syntax.
- Parser ~~use to~~ break in the syntax into parts or series of character then process it.
- If there is any problem in syntax it return the error to user.
- Parser passes Directed Acyclic Graph (DAG) to next step of Pig Latin architecture.



## 2) Hive Server:-

- Hive is use too as warehouse storage tool for Big Data.
- Hive uses Hive SQL which is combination Hive + SQL.
- Hive provide services like data analysis, and data storing and data processing.
- Hive use multi command approach which reduce the line of code.
- In hive data is break into multiple slave using Metadata.
- This slaves are use too process data fastely.

### 3) Data type in Hive :-

- Hive have 2 type of data types are :-

- a) Scalar
- b) Complex

(a) Scalar :- Scalar is use to store single character or number data.

Example of Scalar data is Atom.

(b) Complex :-

Type of Complex data type are :-

- Tuple
- Bag
- Map



→ Tuple:-

- In this type all the data is stored is of same type.
- This type is use to store all data type like byte, int, short, long, string and char.

→ Bag:-

- Bag is a collection non repeated and unique ~~Collection~~ tuple.

→ Map:-

- Map ~~can~~ contain data in format of Key and value like "AF" : 1111
- In Map Key is in text format and value

tuple  $\Leftarrow$ 

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 1 | 0 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 7 | 9 | 5 | 2 | 3 | 4 |
|---|---|---|---|---|---|

 $\Rightarrow$  Bag  

|    |   |   |   |
|----|---|---|---|
| AE | 8 | 1 | 0 |
|----|---|---|---|

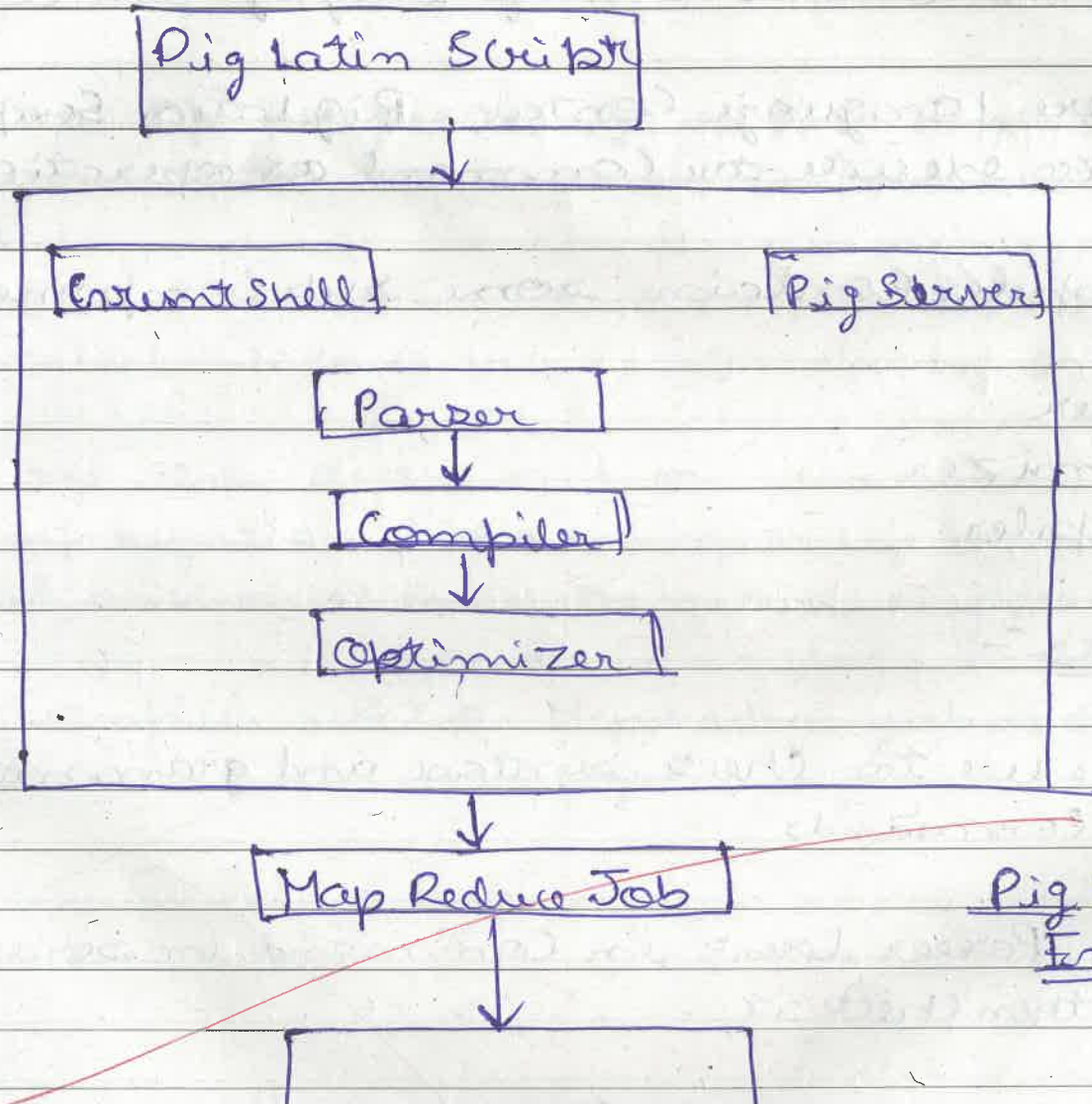
 $\Rightarrow$  Map.

#### 4) Client options for Hive :-

- Client option for Hive as data Analysis tool, data warehouse tool, data processing tool.
- Hive use ~~Hive~~ SQL that is combination of Hive + SQL and It is every much faster than Hadoop
- Client use Hive because it is easy learn and



Q 12



Pig Execution Environment

⇒ Pig is Combination of Language and Compiler.

- Where Language Contain Pig Latin Script. It is use to execute the Command or operation.
- Compiler Contain some sub components are:-

- ① Parser
- ② Optimizer
- ③ Compiler.

① Parser:-

- It is use to check syntax and grammatic error in Commands.
- This Parser break in Command in series of character and then check it.



## ② Optimizer:-

- It is used to optimize the Directed Acyclic Graph Code of parser. Into optimized action plans and statement.

## ③ Compiler:-

9

- It is used to execute the action plans by provide information into map reduce and convert the command into map reduce jobs.
- ⇒ After the Compiler, Action Map reduce job is created which make action in Hadoop.

## Part-B

Q11 The Main reason for Developing Pig Latin:-

1) Language barrier:-

- Some programmers are not good in Java programming so they feel it difficult to use Hadoop.
- For that programmers, pig latin is introduced which SQL base language and work as same as Java does in Hadoop.

2) Optimization issue:-

- All the time of developers are go into optimizing the code of Hadoop. So for this reason Pig Latin



- Developer can only focus on development.

### 3) Make it simple:-

- In Java developer make many error in syntax because syntax of Java is difficult and case sensitive.
- But in Pig language chances of error is reduced.

### 4) Multiple Command:-

- Pig used multiple command approach which can reduce the line code.
- And this multiple command approach make it easier for compiler to execute the code.

Q 10 The necessity of Keeping data secure while conducting Analytics because

- 1) In Data Analytics process any data is changed so it change the result of analysis.
- 2) If the Data security is not maintained, so the authorized user can make changes in data or delete ~~all~~ data which can create huge difference between ~~to~~ actual output and fault output.
- 3) Keeping Data security can maintain the tendency and accuracy of the output of data analysis.
- 4) Analysis is a process in which data is ~~a~~ examine and trends of data is understand. if there is any issue ~~with~~ with data it create big problem in analysis.



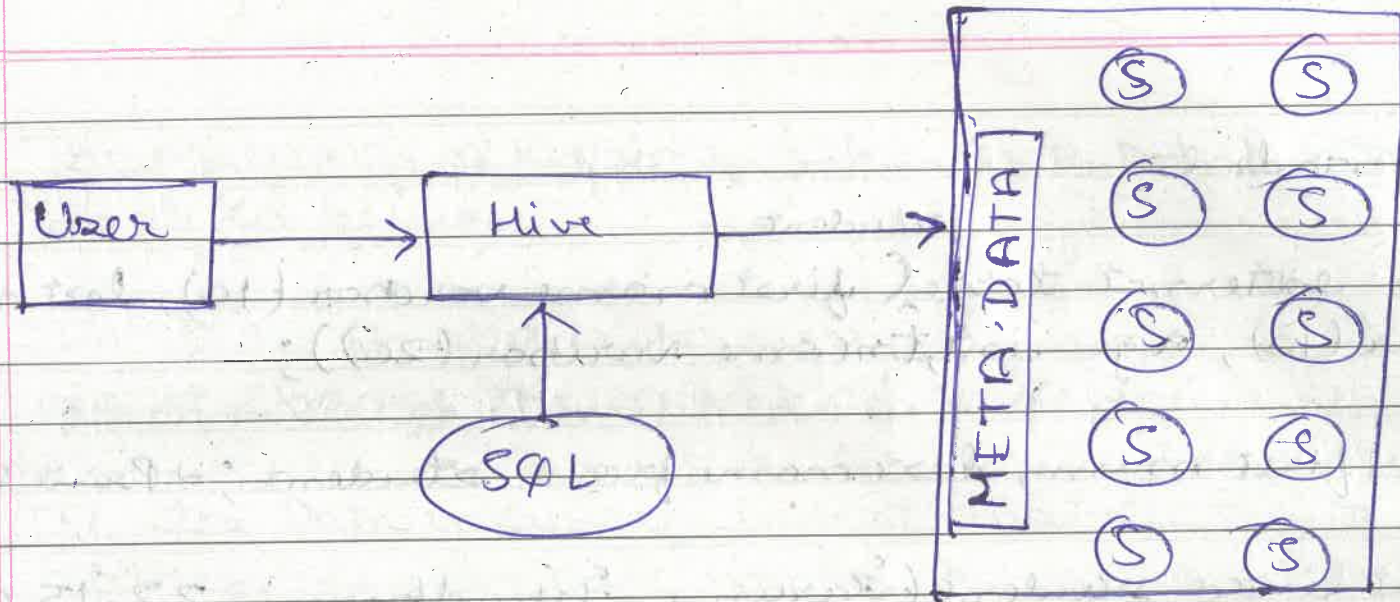
## Q9. Commands :-

student

- Create external table (first name varchar (10), last name varchar (10), age int, income varchar (20));
- Select first name, last name from student; → Print 2 column.
- ④ • Insert into student ('Tarun', 'Upadhyay', 22, '15,00,000');
- Desc student → For schema of table.
- Drop table student → For drop or delete all data of table.

Q6. Hive is data flow language which is use as data warehouse and Data Analysis tool for Big Data

- Hive use Hive SQL language for data processing  
Hive SQL is combination of Hive + SQL



- Hive Convert Hive SQL Commands into action plans.
- This Action plans is converted into map reduce job using meta data.
- This Meta data Convert jobs into slaves which interact with Hadoop Distributed File System.



## Part-A

Q5 Three Hive QL DDL Commands are :-

- 1) Create :- This command is use to define table in data base.
- 2) Update :- It is use to update any value in column or add new column in table.
- 3) Insert :- It is use to insert value in table.

Q4 The importance of Classification in Data Analysis is :-

- Classification in Data Analysis is use to classify the similar data into single group.
- Classification is used to group up and label <sup>ling</sup> of data for further analysis.

Q2 HDFS stand for Hadoop distributed file system  
HDFS command are use to perform operation  
On Big data.

Q3 Matrix Vector Multiplication is a process of  
multiple two vector matrix and make new  
vector matrix.

Q1 Hadoop T A R N is a process of converting Big Data  
into normal data.



**Theory**



# POORNIMA

## COLLEGE OF ENGINEERING

A/B. No. PCE/22/12070.....

|                                |                  |                            |                             |               |                                |
|--------------------------------|------------------|----------------------------|-----------------------------|---------------|--------------------------------|
| RTU Roll No. <u>20EPCCS014</u> | Branch <u>CS</u> | Year <u>3<sup>rd</sup></u> | Sem. <u>VI<sup>th</sup></u> | Sec. <u>A</u> | Class Roll No. <u>20/CS/15</u> |
|--------------------------------|------------------|----------------------------|-----------------------------|---------------|--------------------------------|

|                                           |                                                    |
|-------------------------------------------|----------------------------------------------------|
| Name of Exam <u>First mid term Exam</u>   | Day & Date <u>Saturday &amp; 06/05/23</u>          |
| Name of Candidate <u>Aman Kumar Singh</u> | College Registration No. <u>PCE20CS015</u>         |
| Name of Subject/Paper <u>CAO</u>          | Subject/Paper Code <u>GCS4-04</u>                  |
| Signature of Candidate <u>[Signature]</u> | Name & Signature of Invigilator <u>[Signature]</u> |

| Question No.   | 1   | 2   | 3   | 4   | 5   | 6   | 7 | 8   | 9 | 10 | 11  | 12 | 13 | 14  | 15  | Maximum Marks        | 60 | Signature of Examiner |
|----------------|-----|-----|-----|-----|-----|-----|---|-----|---|----|-----|----|----|-----|-----|----------------------|----|-----------------------|
| Marks Obtained | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 3.5 | - | 3.5 | - | 3  | 3.5 | -  | 7  | 7.5 | 7.5 | Total Marks Obtained | 43 | [Signature]           |

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- Bringing cell phone / communication devices / programmable calculator (i.e. having memory capacity of more than six number) in exam hall is strictly prohibited Exam. Conducting authorities will not keep them under their custody.
- During the course of examination the candidate shall be under the discipline & control of the invigilator & shall obey all orders passed by invigilators on all matters relating to the examinations.



69

00

00



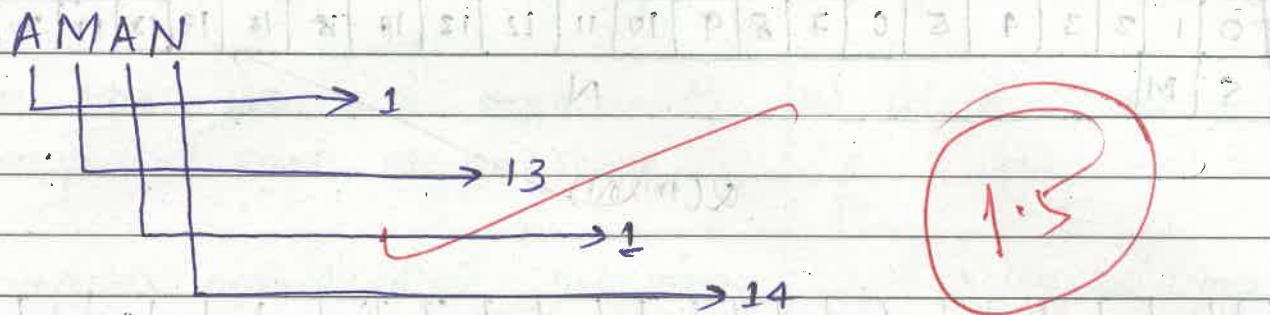
01

01



## Part-A

1)



$$1 = 00000001$$

$$13 = 00010100$$

$$1 = 00000001$$

$$14 = 00010010$$

Ques 2)

If  $(P=1)$  then  $(R_1 \leftarrow R_2)$

- else if  $(Q=1)$  then  $(R_1 \leftarrow R_3)$

1.5

Ques 3)

$(+46.5)_{10}$

|   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| S | M |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |

N

$Q(M, N)$

|   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| M | N |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

$( )_{10}$



4)

### Computer Organization

- 1) In this ~~we~~ we organize the Computer part ~~and~~ and shape.
- 2) Computer organization not manage that how computer

1.5

### Computer architecture

- 1) In this design and assemble all ALU and how computer perform.
- 2) Architecture manage everything of computer that how they work and how give output through functions.

(Ans)

Branch instruction in which we perform a task through lots of instruction provided by us then he which task we do or not but call subroutine in which we

1.5

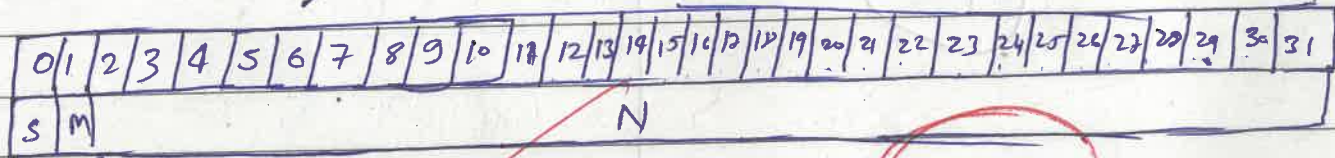
Program interrupt mean in running programme high priority task come then stop the running task and first of all do high priority task.

### Part-B

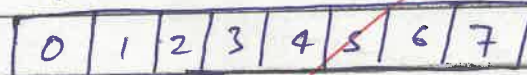
⑥

32-bit

32-bit



8-bit

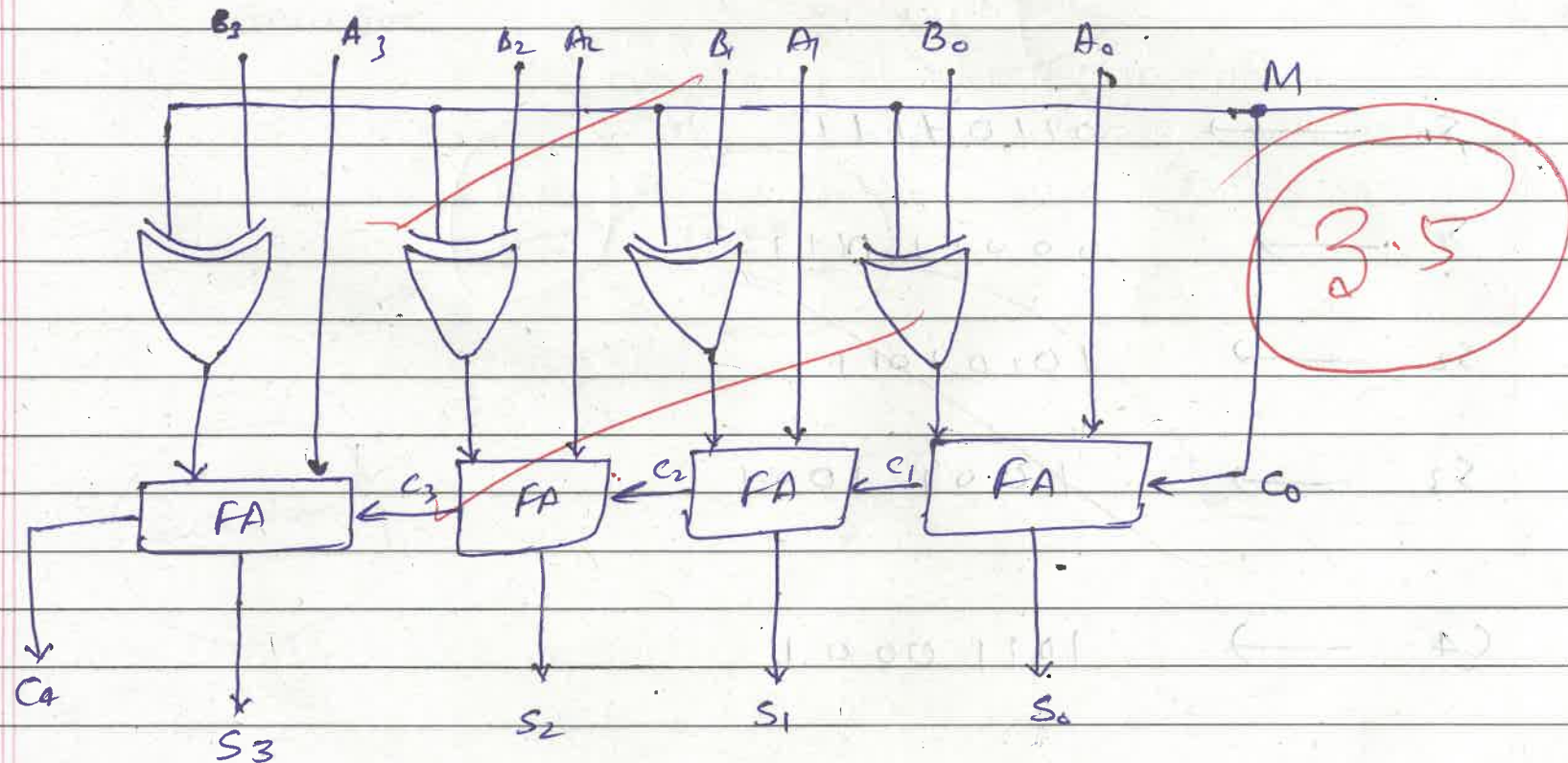


2.5



25 is the largest and 2 is smallest positive quantities. ~~that can~~

8



| M | A    | B    |
|---|------|------|
| 0 | 0111 | 0110 |
| 0 | 1000 | 1001 |
| 1 | 1100 | 1000 |
| 1 | 0101 | 1010 |
| 1 | 0000 | 0001 |

$S_0 \rightarrow 0110 + 111$

$S_1 \rightarrow 0001 + 011$

$S_2 \rightarrow 1010 + 011$

$S_3 \rightarrow 1001 + 1001$

$C_4 \rightarrow 1011 + 0001$



11) Instruction Cycle in which execute the task through 4 stage and give output.

- 1) Fetch data
- 2)
- 3) Read only memory
- 4) Execution

3.5



(10)

a) direct  $\rightarrow$  ADD Z, W

b) indirect  $\rightarrow$  CLC

c) relative  $\rightarrow$  ADD Z, X

d) indexed  $\rightarrow$  MOV Z, 2

3



## Part-c

14)

### Stack organization

In this we perform a task to follow 'LIFO' Last in first out. through stack we easily add data and retrieve data also. In this push and pop operation performed. In stack organization we easily perform task and find output. They can manage our program that we want to run on a system.

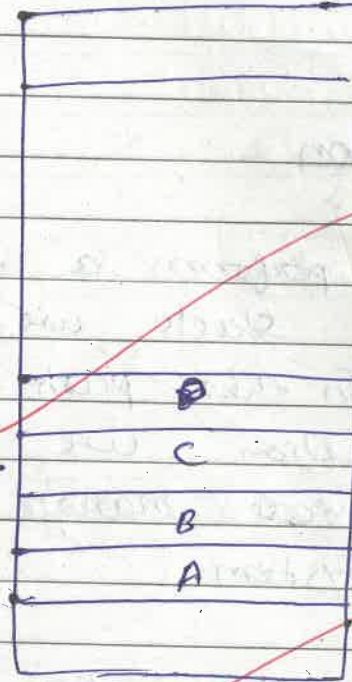
7.5

### General register Organisation

In general register organization do not follow the 'LIFO' that why in this task were run slowly and give output very late. In this we can't easily add or retrieve data from memory and there is no any push and pop operation that help to execute our program.



SR



DR

Stack organization



## ⑮ Addressing in the Memory are:-

- It is very important to perform a task.
- Through addressing we can execute the task.
- Without addressing we never get data from the memory.
- Without addressing data were lost.
- Addressing Manage the our memory to store data properly and good manner that can easily accessible for programmer.
- If we don't assign any address of data in database then how we fetch data.
- In Database all the data were store in such a manner that we found at a time.

⑬

a) direct  $\rightarrow$  ~~Mov~~ Mov R<sub>1</sub> 301

b) immediate  $\rightarrow$  ADD R<sub>1</sub>, 400

c) relative  $\rightarrow$  Add 300, 400

d) register @ indirect  $\rightarrow$  ~~Mov~~ R<sub>1</sub> 300.

e) ~~400~~ 200



22742

A/B. No. PCE/22/.....

Theory



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## COLLEGE OF ENGINEERING

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| RTU Roll No.....20EPCIT043..... | Branch.....IT..... | Year.....3 <sup>rd</sup> ..... | Sem.....V..... | Sec.....D..... | Class Roll No.....41..... |
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|                                          |                                                                                                                                 |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Name of Exam.....Second Mid Term.....    | Day & Date.....Thursday 05/01/2023.....                                                                                         |
| Name of Candidate.....Rahul Purohit..... | College Registration No.....PCE 20 IT 036.....                                                                                  |
| Name of Subject/Paper.....OS.....        | Subject/Paper Code.....5ITU-03.....                                                                                             |
| Signature of Candidate.....Rahul.....    | Name & Signature of Invigilator.....  ..... |

| Question No.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks        | 60 | Signature of Examiner                                                                 |
|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------------------|----|---------------------------------------------------------------------------------------|
| Marks Obtained | 0 | 2 | 2 | 0 | 2 | 4 | — | 5 | 4 | —  | 6  | 5  | 8  | —  | —  | Total Marks Obtained | 38 |  |

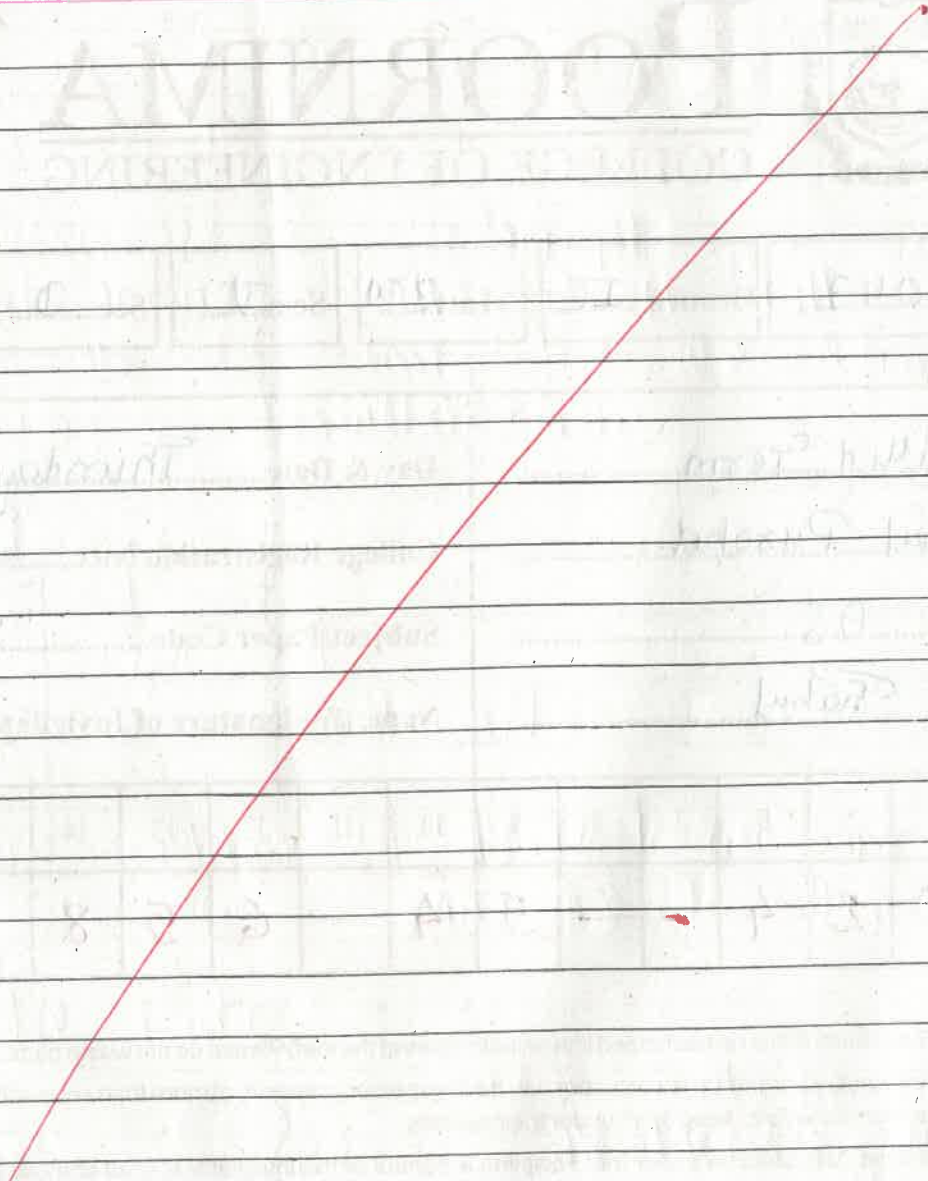
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- During the course of examination the candidate shall be under the discipline & control of the invigilator & shall obey all orders passed by invigilators on all matters relating to the examinations.



76  
18  
54  
196  
16  
12

174  
30  
208





## Past - A

Q.2) The attribute of files :-

- 1.] Name
- 2.] Extension [type]
- 3.] Identifier
- 4.] Location
- 5.] Size
- 6.] Modified by /  
Created by
- 7.] Protection / Permission
- 8.] Encryption / Compression

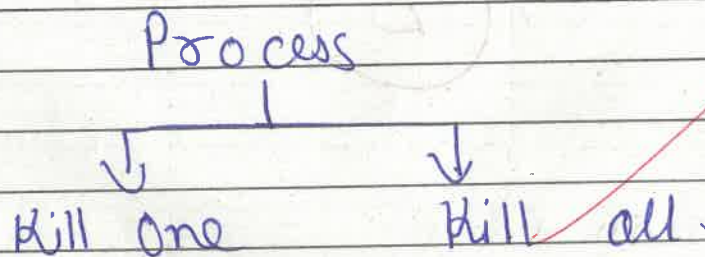
2

Q.3) Method for Deadlock Recovery

The Deadlock can be recover based on the

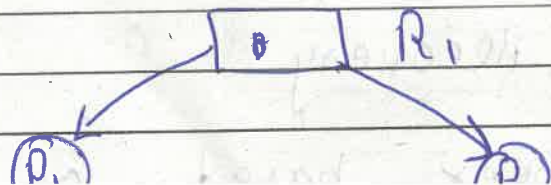
or Process [which are assign some resources]

Resources  $\rightarrow$  Preempt  
Preempt means either it will be work  
till its complet execution  
Resources Dis allocation.



If there is condition of Deadlock we can Kill either one process so resources can give to other or Kill all process

Q.1)



These will be condition of Deadlock, becoz, resources



Q5.]

Starvation

Deadlock.

- 1.] Starvation is situation in which processes are executed according to their priorities.
  - 2.] It is for finite time.
  - 3.] There will be execution of processes but it takes long time.
  - 4.] There is no fix bound that every starvation goes into Deadlock.
- 1.] Deadlock is situation in which one process is waiting for some resources which has been already allocated to some other process.
  - 2.] It is for infinite time.
  - 3.] There will be no execution of processes.
  - 4.] There is always fix that every Deadlock is said to be starvation.

Q4.] file available in file system, can be of various type so as eg are pdf, jpg, html, c, doc.

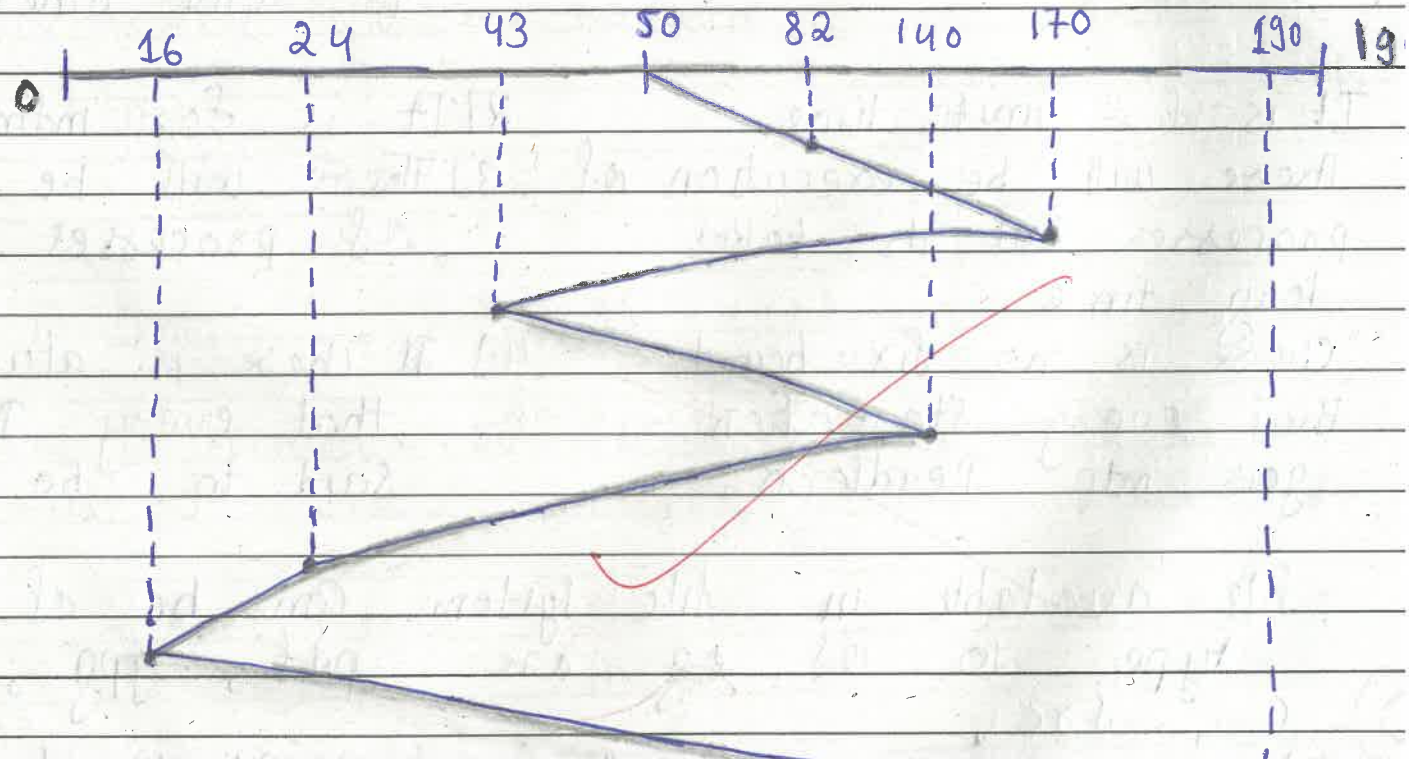
It is divided into Block and Streaming.

## Part - C

Q 120

Request queue 82, 170, 43, 140, 24, 16, 190  
current position of R/W head = 50.

1) FCFS (first come first serve)



16  
16  
34  
190  
16  
17

174  
54  
208



Total no of track movement by R/w head

$$= (82 - 50) + (170 - 82) + (170 - 43) + (140 - 43) \\ + (140 - 24) + (24 - 16) + (190 - 16)$$

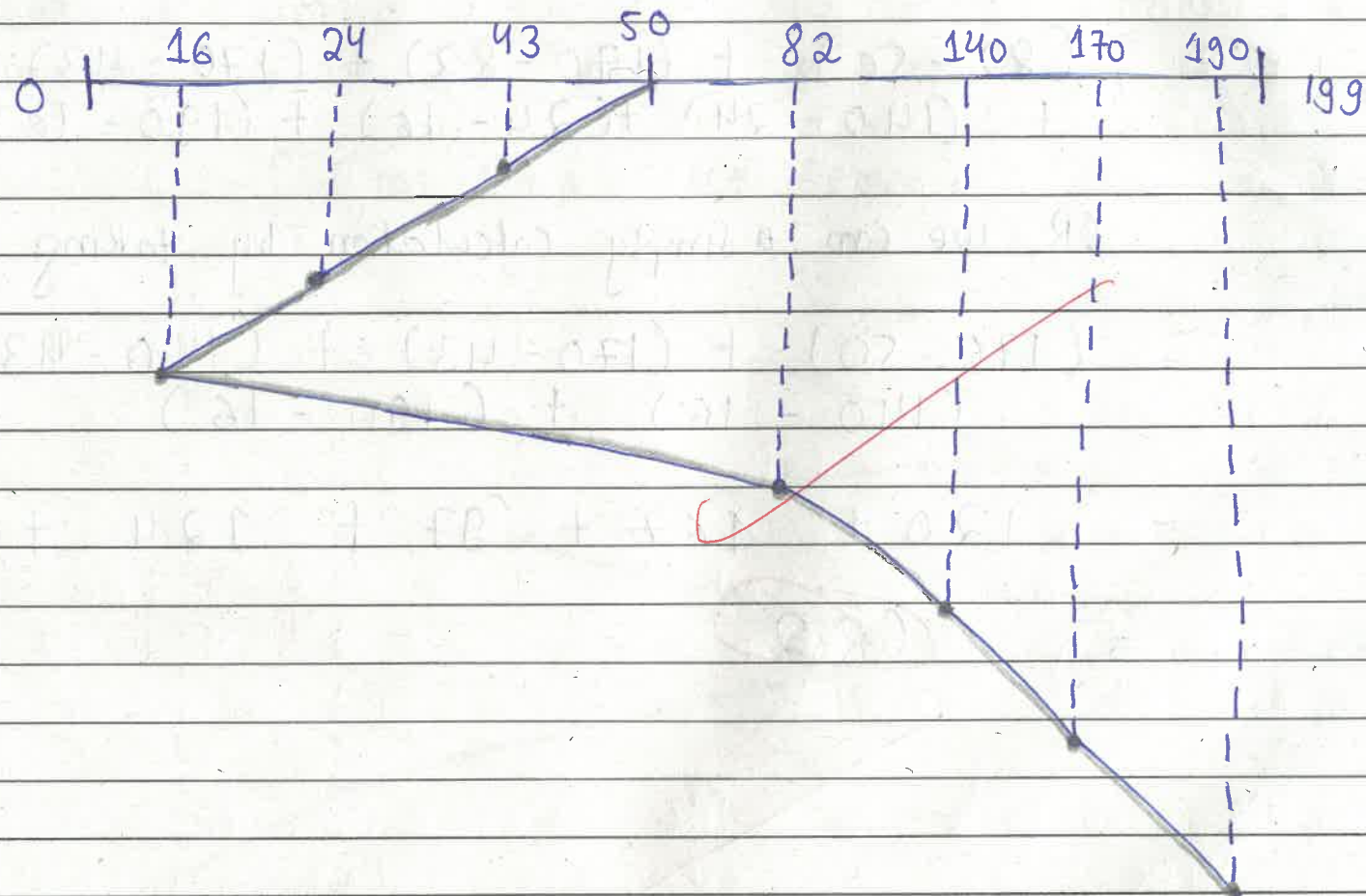
OR we can do simply calculation by taking complete edge

$$= (170 - 50) + (170 - 43) + (140 - 43) + \\ (140 - 16) + (190 - 16)$$

$$= 120 + 167 + 97 + 124 + 174$$

$$= 682$$

2.) SSTF (Shortest seek time first)



56  
16  
34

190  
16  
17

74  
34  
208



Total number of track movement by R/W Head.

$$= (50 - 16) + (190 - 16)$$

$$= 34 + 174$$

$$= \underline{208}$$

6

The number of track movement by R/W head is 208

Q 143

| Process        | Allocation |   |   |   | Max |   |   |   | Available |    |   |    |
|----------------|------------|---|---|---|-----|---|---|---|-----------|----|---|----|
|                | A          | B | C | D | A   | B | C | D | A         | B  | C | D  |
| P <sub>1</sub> | 2          | 0 | 0 | 1 | 4   | 2 | 1 | 2 | 3         | 3  | 2 | 1  |
| P <sub>2</sub> | 3          | 1 | 2 | 1 | 5   | 2 | 5 | 2 | 5         | 3  | 2 | 2  |
| P <sub>3</sub> | 2          | 1 | 0 | 3 | 2   | 3 | 1 | 6 | 6         | 6  | 3 | 4  |
| P <sub>4</sub> | 1          | 3 | 1 | 2 | 1   | 4 | 2 | 4 | 7         | 10 | 6 | 6  |
| P <sub>5</sub> | 1          | 4 | 3 | 2 | 3   | 6 | 6 | 5 | 10        | 11 | 8 | 7  |
|                |            |   |   |   |     |   |   |   | 12        | 12 | 8 | 10 |

$$\begin{array}{r} 50 \\ 16 \\ \hline 34 \end{array}$$

$$\begin{array}{r} 196 \\ 18 \\ \hline 178 \end{array}$$

$$\begin{array}{r} 174 \\ 254 \\ \hline 208 \end{array}$$



1.) Need (Requirement)  $\rightarrow$  i.e. (Max - Allocation)

|                | A | B | C | D |   |
|----------------|---|---|---|---|---|
| P <sub>1</sub> | 2 | 2 | 1 | 1 | ✓ |
| P <sub>2</sub> | 2 | 1 | 3 | 1 |   |
| P <sub>3</sub> | 0 | 2 | 1 | 3 |   |
| P <sub>4</sub> | 0 | 1 | 1 | 2 | ✓ |
| P <sub>5</sub> | 2 | 2 | 3 | 3 | ✓ |

8

2.) ~~Safe~~ Sequence  $\rightarrow P_1 \rightarrow P_4 \rightarrow P_5 \rightarrow P_2 \rightarrow P_3$   
 This is the safe sequence of given matrix.  
 There is no deadlock condition.

Q 13)

Real time operating system is the software which updates, create, manipulate these present data on the given time. there will be no lag in the system. all the instructions and the given command will be executed on time.

Real time operating system work on efficient memory access. and these data will be of limited set. so that they can be give us update on the required time. there will be no speed issues.

76  
10  
4

196  
16  
17

174  
34  
208



to mobile view.  
mobile ~~data~~ operation system works  
more efficiently because it has  
all the requisite memory element.

Mobile operations system are very much  
familiar then we have to use  
it for the longer run.

50  
 16  
 34  
 196  
 16  
 17

174  
 54  
 208



## Part : B

Q.6.]

1.]

| Process.       | Allocation |   |   | Max          |              |              | Available |   |   | Need (Requirement)<br>(Max - Allocation) |   |   |
|----------------|------------|---|---|--------------|--------------|--------------|-----------|---|---|------------------------------------------|---|---|
|                | A          | B | C | A            | B            | C            | A         | B | C |                                          |   |   |
| P <sub>1</sub> | 0          | 1 | 0 | 7            | 5            | 3            | 3         | 3 | 2 | 7                                        | 4 | 3 |
|                |            |   |   | <del>3</del> | <del>2</del> | <del>2</del> |           |   |   |                                          |   |   |
| P <sub>2</sub> | 2          | 0 | 0 | 3            | 2            | 2            | 5         | 3 | 2 | 1                                        | 2 | 2 |
| P <sub>3</sub> | 3          | 0 | 2 | 9            | 0            | 2            | 7         | 4 | 3 | 6                                        | 0 | 0 |
| P <sub>4</sub> | 2          | 1 | 1 | 2            | 2            | 2            | 7         | 4 | 5 | 0                                        | 1 | 1 |
| P <sub>5</sub> | 0          | 0 | 2 | 4            | 3            | 3            | 7         | 5 | 5 | 4                                        | 3 | 1 |
|                |            |   |   |              |              |              | 10        | 5 | 7 |                                          |   |   |

4

2.] Sequence  $\Rightarrow P_2 \rightarrow P_4 \rightarrow P_5 \rightarrow P_1 \rightarrow P_3$

Yes, The system is in Safe state. the above written is the safe sequence.

$\therefore$  There is no deadlock condition can be occur in the system.

Q. 3]

The Deadlock is the situation in which process is waiting for some resources which has been already allocated to some other process and that particular process is also waiting for some resources to be freed so that it can complete its execution but that is eventually not going to happen. All the processes are waiting simultaneously for each other's resources to be freed / Unassigned.

⇒ Necessary condition for Deadlock are the four as follows:

1. Mutual Exclusion



2.) No Preemption

3.) Hold and wait

4.) Circular wait

1.) Mutual exclusion : This condition states that processes should be in mutual exclusive manner. that every resources may not be shared with the other process at same time.

2.) No Preemption :- This Basically means if any process once started then it will only be executed after its fully completion.

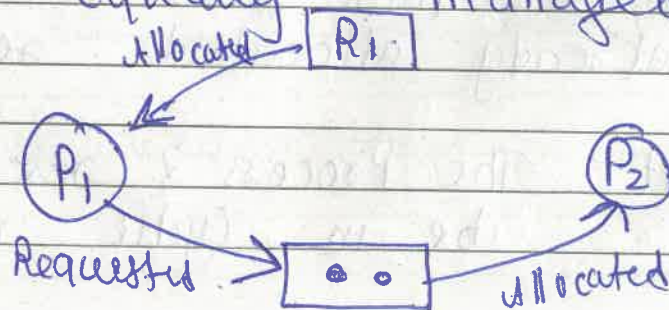
3.) Hold and wait :- The process have to request for other resource with simultaneously holding the already allocated resources.

last ~~first~~ process need / requested the resources which has been already allocated to first process.

Resource graph Model :- This is <sup>Graphical</sup> representation of all the process and resources allocation and request currently.

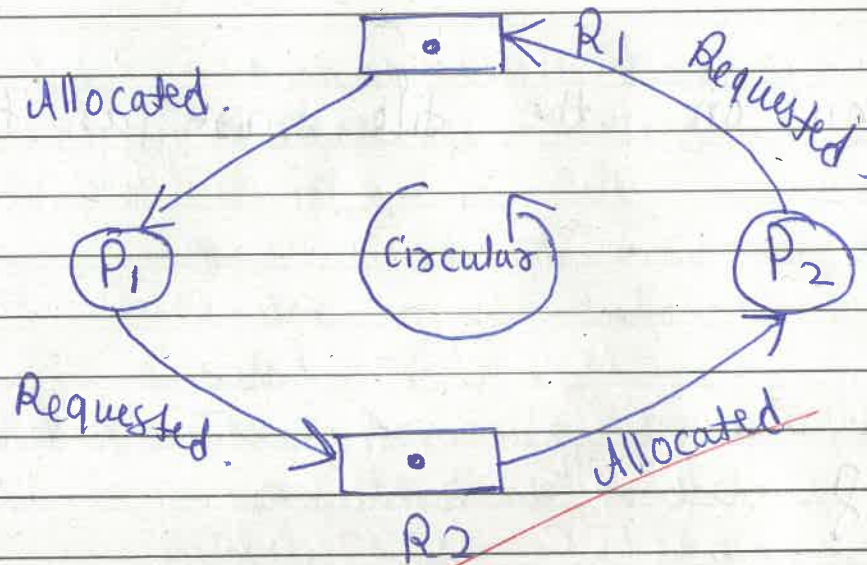
Resources can have single (1) or Multiple instances.  
Process are represented in Circle  
Resources are represented in Rectangular

Safe :- This Condition is said to be when there is no situation for Deadlock to be happen.  
All the given process and resources in the system are equally managed.





Unsafe  
e.g.:



5

Unsafe condition is said to be when there is presentation of Deadlock situation.

Q 100

The operation on the file are as follows:-

1.) Reading.

2.) Writing

3.) Creating.

4.) Truncating

5.) Deleting

Creating : It is the initial process in any file system where we create a different type of files which can be of a different type. eg: pdf, jpg, html etc.

Truncating: This is basically a method from which we read or bring out it



from the permanently storage device which is already saving and working on multiple files.

Writing :- This is the condition in which we are writing some data or information on already created file.

Truncation :- This basically means that we are shorting the data or information which is already present in our file so that it can be easily and faster access. These will be less memory consumption.

Deletion :- This method help us in removing unwanted file which works is already completed or no more requirement is there of that file.

The file access of file system.

It can be done using

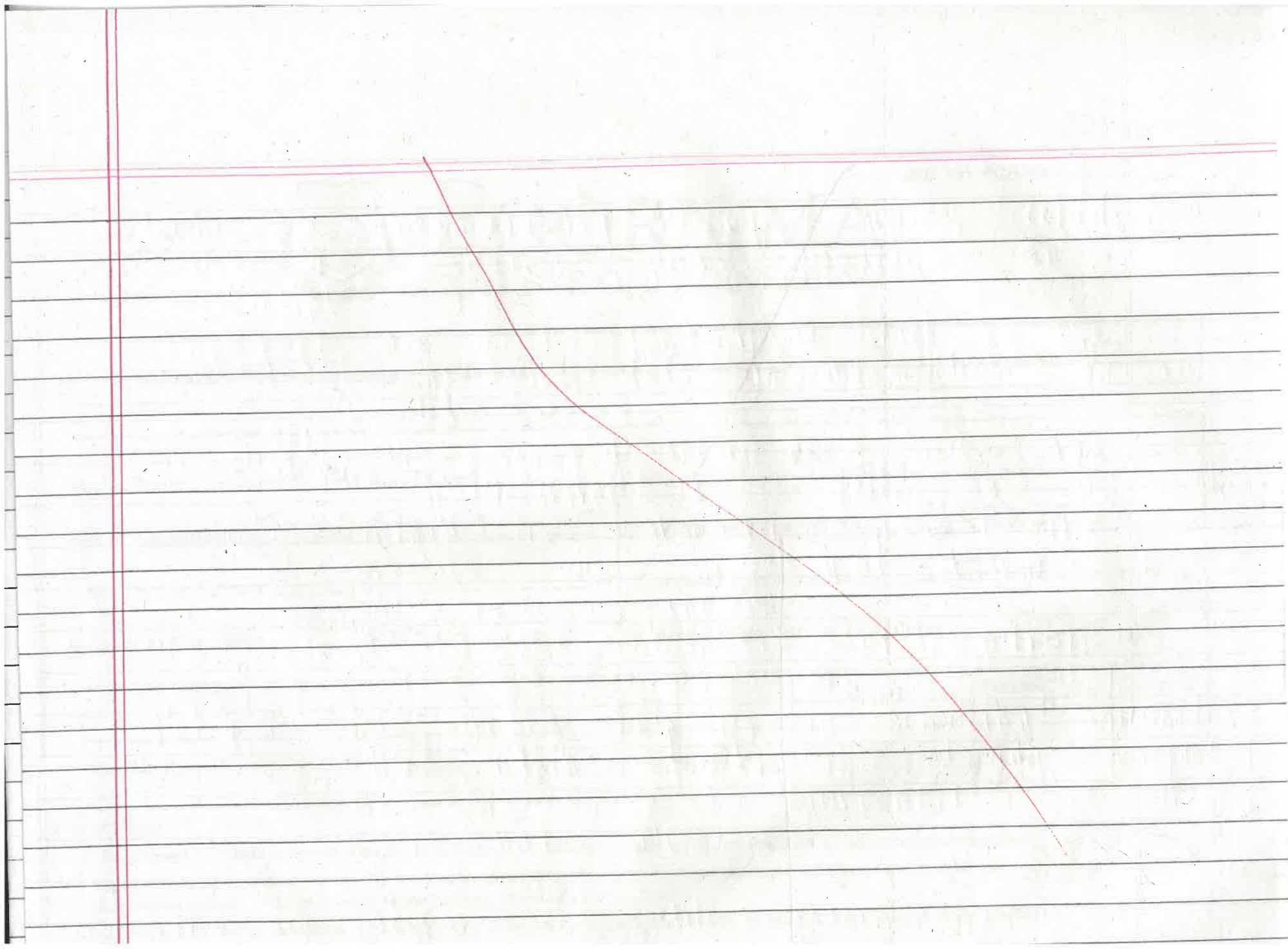
- 1.) Random Access Method.
- 2.) Indexation Access Method.
- 3.) Pointer Access Method.

④ 1.) Random Access Method : In this method we save the data in the ~~Contiguous~~ random Memory allocation. Data will be present

2. Pointer Access Method : we need to make a pointer of each address block of data and that is store in previous block.  
eg : linked list.

Indexation : In this we maintain a block which store the ~~data~~ <sup>Addresses</sup> of





**Theory**



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|                                |                     |                |                 |               |                                              |
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| RTU Roll No. <b>EPC21AD034</b> | Branch <b>AI DS</b> | Year <b>II</b> | Sem. <b>III</b> | Sec. <b>E</b> | Class Roll No. <b>41AD1033</b><br><b>033</b> |
|--------------------------------|---------------------|----------------|-----------------|---------------|----------------------------------------------|

|                                                           |                                                     |
|-----------------------------------------------------------|-----------------------------------------------------|
| Name of Exam. <b>FIRST MID TERM EXAM 2022-23</b>          | Day & Date. <b>Friday 8 14/10/22</b>                |
| Name of Candidate. <b>Naina chibermalani</b>              | College Registration No. <b>PCE21AD033</b>          |
| Name of Subject/Paper. <b>Object oriented Programming</b> | Subject/Paper Code. <b>3CS4-06</b>                  |
| Signature of Candidate. <b>Naina</b>                      | Name & Signature of Invigilator. <b>[Signature]</b> |

| Question No.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks        | 60 | Signature of Examiner |
|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------------------|----|-----------------------|
| Marks Obtained | 0 | 2 | — | 0 | 0 | 5 | 4 | — | — | 3  | 5  | —  | 10 | 8  | 8  | Total Marks Obtained | 45 | <b>[Signature]</b>    |

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## Part B

Q7)

If a function is inline the compiler places a copy of the code of that function at each point where function is called at compile time.

Yes the statement is correct, usually, sometimes, when we call a function and define, declare & call a function it takes time to switch these, which is time consuming and this problem that arises is called ~~an~~ "overhead" problem. ~~to~~ to resolve the issue of this overhead problem the inline functions are used here, so that it may reduce the time of ~~exe~~ of and make the code more efficient.

ex  $\Rightarrow$ 

```
inline : function name;
{
    argument
}
inline function name;
{
}
```



Q(10)

Yes, we can use the same function name for a member function of a class and an outside function in same program file.

If the function parameters are different in both inside & outside the condition is called ~~overload~~ "FUNCTION OVERLOADING".

it is a type of "polymorphism" which means (poly → different and morphism → forms) the function having same name but different forms.

Yes they can be distinguished using scope resolution operator.

By scope resolution operator (::) we can distinguish the functions.

3

EX ⇒  
class A :: function\_name (argument 1);  
class B :: function\_name (argument 2);

class A having the same function as in class B which we can distinguish using this scope resolution operator, so that this condition don't arises. and computer can access, # as well as compile the program easily without any error. and execute it well without getting confused that which class's function is there.



Q.11)

output  $\Rightarrow$

Enter first value: 9  
Enter second value: 10  
~~Sum = 9 + 10~~  
Sum of values = 19

Here 2 operators are used first is new & second one is delete  
these operators are used in dynamic memory allocation  
new operator is used when we need to create memory  
for any variable or object or member during run time  
the operator which is used to create or allocate memory  
during run time is called "new operator"  
Syntax  $\Rightarrow$  <sup>var</sup>~~ptr~~-name = new datatype [size];

delete operator  $\Rightarrow$  is used when we have already allocated mem  
using new operator or dynamic memory allocation & now  
we have to free up that space then the operator we use for  
this operation is called delete operator.

Q6) CONSTRUCTOR  $\Rightarrow$  A special type of function, when a class name & function name is ~~same~~ then same inside that class, then this constructor calls itself automatically

ex  $\rightarrow$  class A  

```
{ A() {  
    }  
};
```

DESTRUCTOR  $\Rightarrow$  A constructor is when destroyed after after calling it then it is called destructor

ex  $\rightarrow$  class  

```
{ A()  
  ~A()  
};
```

(15)  
ex  $\Rightarrow$ 

```
#include <iostream.h>  
using namespace std;  
class A  
{ A()  
  { void get a = 5, b = 10;  
    void get A()  
    { cout << "a is =" << a; }  
  }  
  void get B()  
  { cout << "b is =" << b; }  
};
```



```

class A {
# include <iostream.h>
using namespace std;
class A
{
    A() // default constructor
    {
void inpt()
        a = 5;
        void inpt()
        {
            cout << "a is " << a;
        }
int set A()
        {
            return a;
        }
    }
    ~ A() // destructor
    {
        void inpt();
    }
};

```

Here A() is constructor, in which function void inpt() is created and ~~int set A()~~ is created, now ~~the~~ after calling destructor "~ A()", the void inpt() function gets deleted or destroyed.

## part C

Q13) All members functions of class granted friendship have unrestricted access to the members of class granting friendship.

Yes I agree with the above statement, when a friend function is created ~~the~~ inside a class then after that when that class is inherited to the derived class, in that when we use the function which we have created, then we can access the data members ~~or mem~~ even if it is private.

For example  $\Rightarrow$



```
#include <iostream>
```

```
class check {
```

```
{
```

```
friend void check(s1);
```

```
};
```

```
class B : class public check
```

```
{
```

```
friend void check(s1);
```

```
}
```



We can friend the whole class as well, In Inheritance, we can access the public functions ~~as well~~, but using friend function we can access the private data members or member functions of the base class in derived class

```
EX -> #include <iostream, h>

class Vehicles {
public:
    vehicle() {
        cout << "This is a vehicle";
    }
};

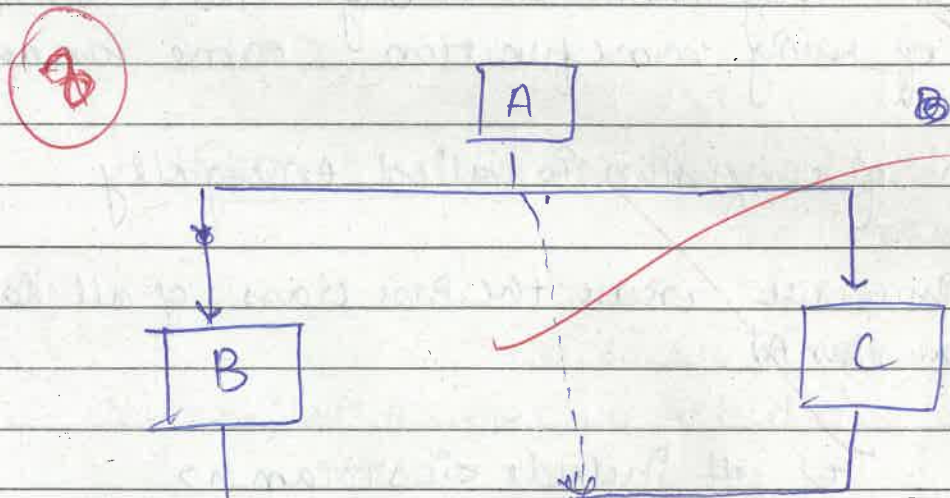
class TwoWheeler : friend class Vehicles
friend class Vehicles;

};

class TwoWheeler : Public Vehicles
{
    private:
    TwoWheeler()
    {
        cout << "This is Two wheeler";
    }
}
```

In this I have created one base class named vehicle and ~~a friend class~~ that I have created vehicle function and friend the class Two wheelers and ~~can~~ in that created function two wheelers() and also called the same function vehicles(); instead of it is private ~~that is~~, I can access that function and all the functions, data members, objects in the friend class either it is private or public.

Q14) we can prevent multiple "instances" of given class from appearing in an inheritance hierarchy when using multiple or hybrid inheritance.





Here class A is ~~at~~ inherited in both B and C classes and then from both B & C class, class D is inherited.

As we know ~~Deco~~ class D can inherit the properties, data members, member functions or objects of class A, class B and class C still to ignore the problem of "ambiguity" or to resolve the problem of "ambiguity" we use virtual class.

"Ambiguity" is the issue occurred when ~~2~~ such classes like D class ~~at~~ don't directly inherit the properties of base class of all classes. (such as class A) they inherit it through other classes, where the function problem of having same function name can arise and creates confusion.

This phenomenon of confusion is called Ambiguity.

and to resolve this issue we create the Base class of all classes as Virtual class (Here class A).

```
class B: virtual class A;
```

```
{
```

```
    _____  
    _____  
    y;
```

```
class C: Pub virtual class B;
```

```
{
```

```
    _____  
    _____  
    y;
```

```
class D: Virtual public class A
```

```
{
```

```
    _____  
    _____  
    y;
```

Q15)

Abstract class  $\Rightarrow$  These classes are the classes which uses pure virtual function to serve the derived class.

(B)

These classes don't have any initialization (object created). They are just to serve the derived class.



```

class A
{
    void setA(A());
};

```

```

class B : public A
{
    void setA() : virtual int setA();
};

```

```

class C : public A

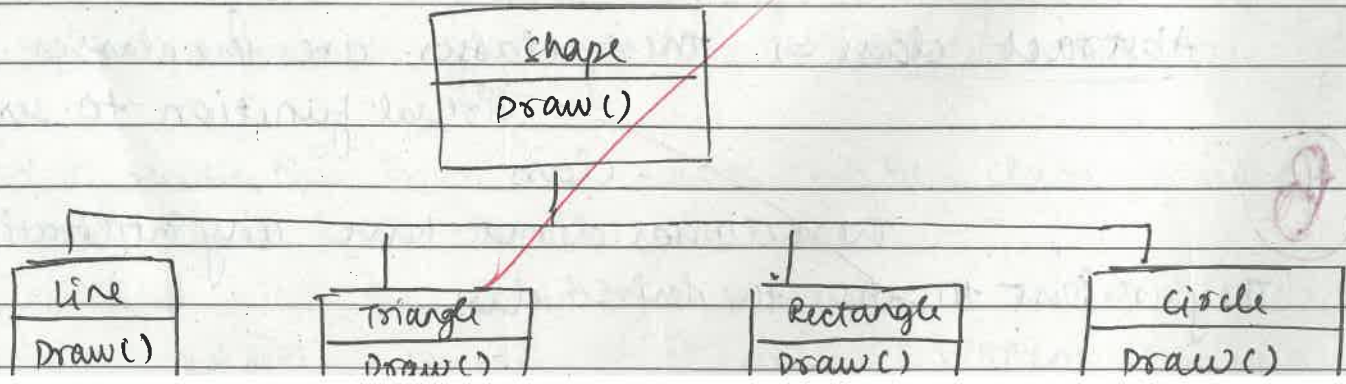
```

```

{
    void setC() : virtual int setA();
};

```

virtual function.



```
#include <iostream.h>
```

```
using namespace std;
```

```
class shape
```

```
{
```

```
public:
```

```
draw()
```

```
{ cout << "this is a shape"; }
```

```
};
```

```
class line : class public shape
```

```
{
```

```
draw()
```

```
{ cout << "this is a shape";
```

```
cout << "this is a line"; }
```

```
};  
class Triangle : public shape
```

```
{
```

```
draw()
```

```
{ cout << "this is a shape";
```

```
cout << "this is a triangle";
```

```
};
```

```
};
```



```

{ cout << "This is a shape";
  cout << "this is rectangle"; }
};

class circle : class public shape
{ Draw ()
  { cout << "this is a shape";
    cout << "this is circle"; }
};

```

### Part A

Q1)

~~memory~~ A class occupy memory by using pointers, dynamic memory allocation, structures and many more.

Q2)

An approach to the development of procedure oriented programs is that

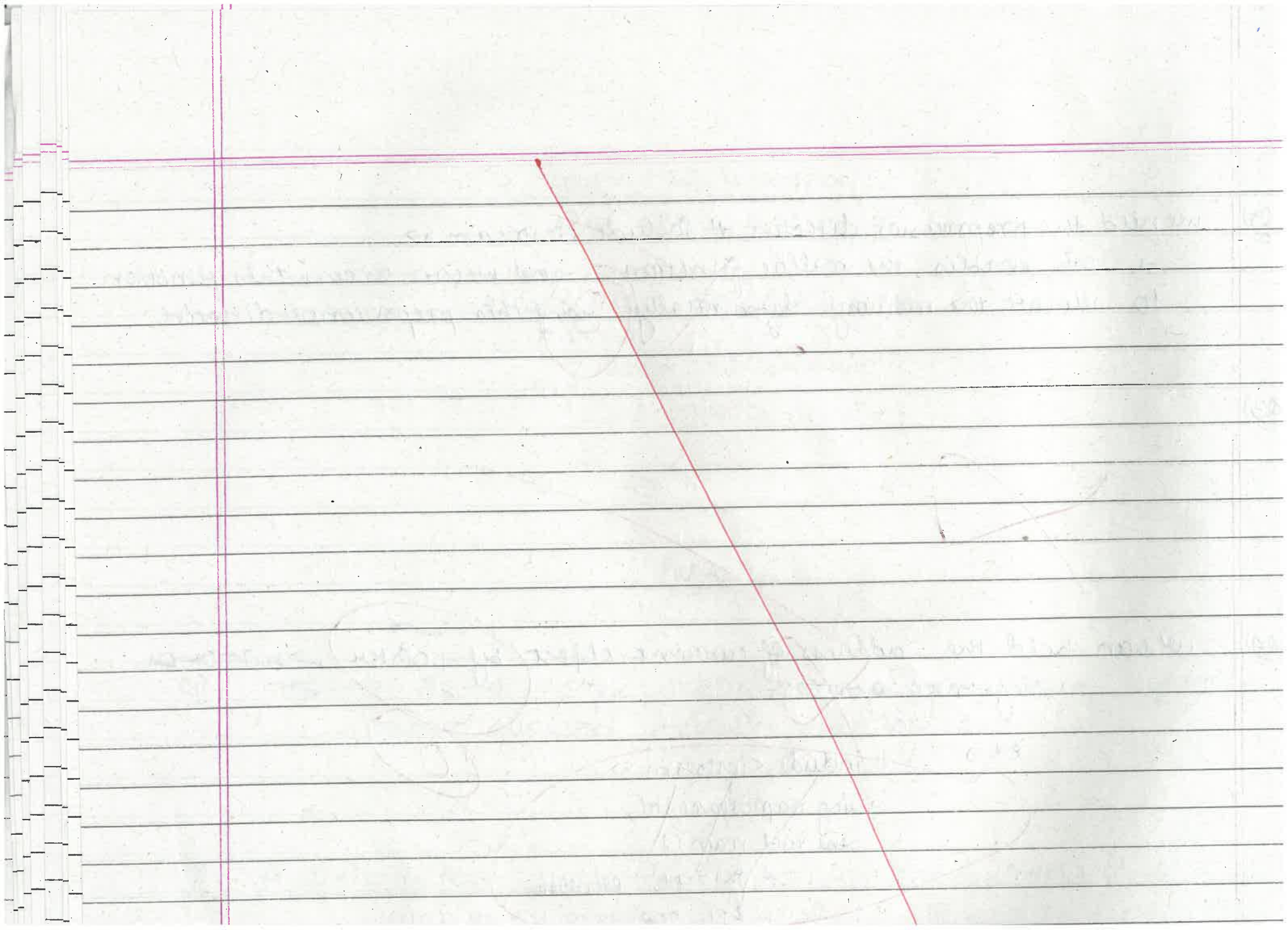
Q5) we need the preprocessor directive `#include <iostream.h>`  
This enables the `malloc` function and we can access this function to allocate the memory dynamically using this preprocessor directive.

Q3)

Q4) we can hold the address of current object by <sup>using</sup> pointer ~~new~~ ~~operator~~

Ex →  
`#include <iostream.h>`  
`using namespace std;`  
`int void main()`  
`{ int *p1, *p2, sum;`  
`p1 = new`





Theory



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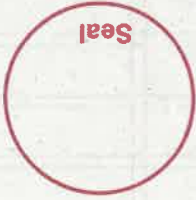
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| RTU Roll No. 21EPCC054 | Branch. Ciba | Year. 1 <sup>st</sup> | Sem. 1 <sup>st</sup> | Sec. F | Class Roll No. 54 |
|------------------------|--------------|-----------------------|----------------------|--------|-------------------|

|                                          |                                     |                                                                |                                  |
|------------------------------------------|-------------------------------------|----------------------------------------------------------------|----------------------------------|
| Name of Exam. First Mid Term Examination | Name of Candidate. Shubham Sagaraj  | Name of Subject/Paper. Data Communication and Computer Network | Signature of Candidate. Shubham  |
| Day & Date. Monday 8/5/2023              | College Registration No. RCE21C1052 | Subject/Paper Code. HES4-03                                    | Name & Signature of Invigilator. |

| Question No.         | 1   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks | Signature of Examiner |
|----------------------|-----|---|---|---|---|---|---|---|---|----|----|----|----|----|----|---------------|-----------------------|
| Marks Obtained       | 2   | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2  | 2  | 2  | 2  | 2  | 2  | 2             | 2                     |
| Total Marks Obtained | 8.5 |   |   |   |   |   |   |   |   |    |    |    |    |    |    | 8.5           | 26                    |

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Ans 13 Go-Back N ARQ Selective Repeat ARQ

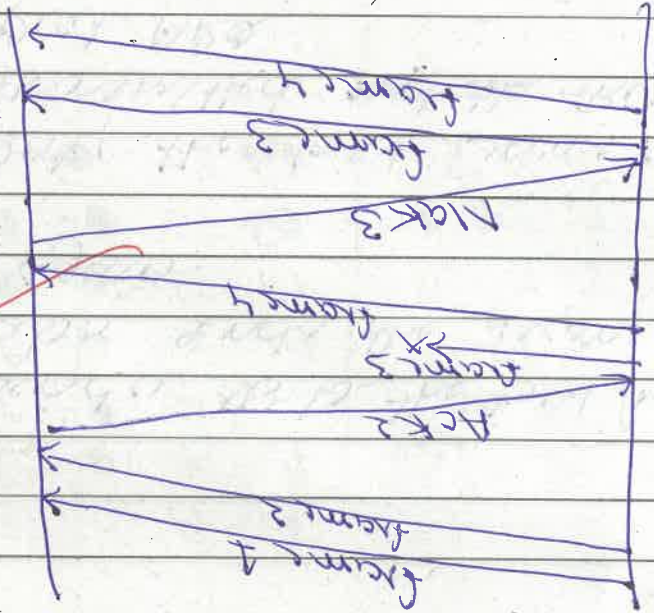
(i) Go-Back N ARQ is used to send the frame which is lost during the transmission. The frame after the last frame is sent again in Go-Back N ARQ.

ARQ

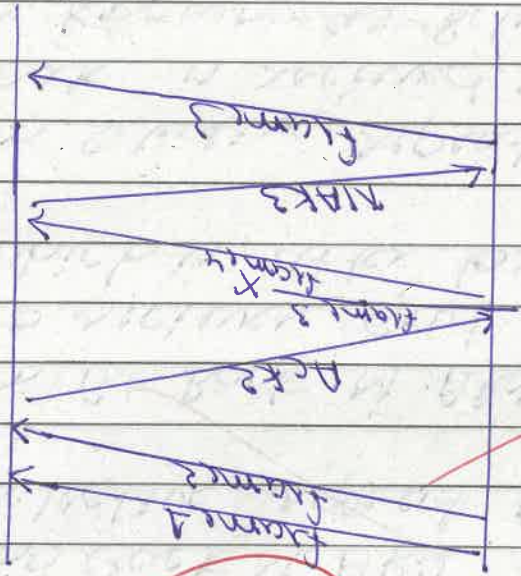
(ii) Selective Repeat ARQ is used to send the particular frame which is lost during the transmission rather than other frames. Thus it is known as selective Repeat ARQ.

8.5

(ii) Sender Receiver



(ii) Sender Receiver





Condition when negative acknowledgement is generated:-

NAK or negative acknowledgement when the sender transmits a frame but due to some reasons

the frame is lost in medium and didn't received

by the Receiver and the next frame is received

received by the receiver in that case Receiver send

a negative Acknowledgment so that the sender is

able to get that the frame for which the NAK is

received is not received by the receiver. After the

negative Acknowledgment the sender again transmit

the frame using any one of this method.

Go Back N ARQ

Selective repeat ARQ

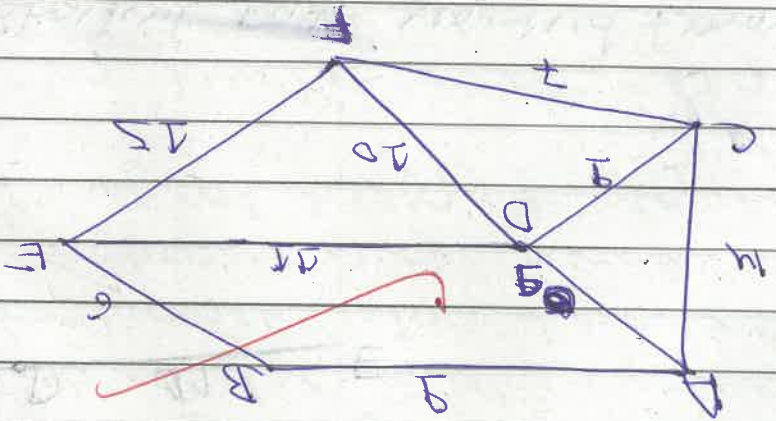
1)  
2)

In Go Back N ARQ, the sender sends the lost frame to receiver and ~~the~~ also sends the frame which is after lost frame again.

In selective repeat ARQ, only the lost frame which is received is only transmitted ~~that~~ this is known as selective repeat ARQ



Ans: Dijkstra's algorithm for given graph

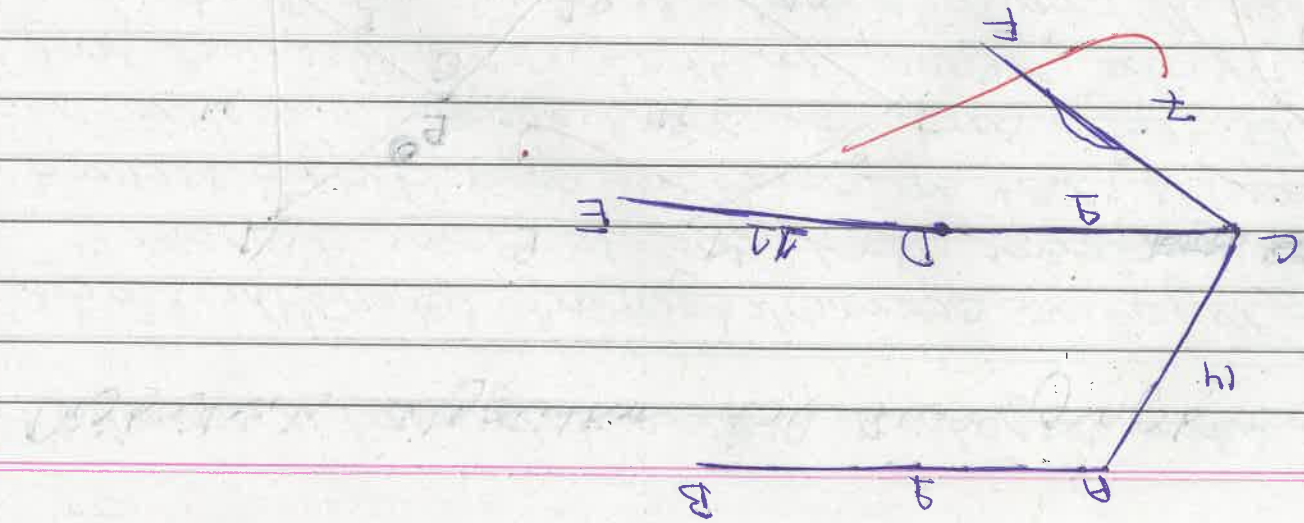


8.5

Source node = C and destination node is E

| A  | B  | C | D | E  | F |
|----|----|---|---|----|---|
| 14 | X  | 0 | 9 | X  | 7 |
| 14 | X  | 0 | 9 | 22 | 7 |
| 14 | X  | 0 | 9 | 20 | 7 |
| 14 | X  | 0 | 9 | 20 | 7 |
| 14 | 23 | 0 | 9 | 20 | 7 |
| 14 | 23 | 0 | 9 | 20 | 7 |
| 14 | 23 | 0 | 9 | 20 | 7 |
| 14 | 23 | 0 | 9 | 20 | 7 |

(Minimum path)



Above graph is the shortest path required from source to destination. Dijkstra Algorithm works as based on minimum spanning tree. In Dijkstra Algorithm we have to select a source node to start the process. In this case we start with node C then we check for the nodes link to C the nodes directly link to C are A, D, F out of these three the minimum distance is of F = 7 so we select point C, F. Now F is connected with D, E but distance C-D is less compared to C-F-D so we use C-D similarly identify path for the remaining nodes.



Ans 15) The performance measure of the reliable transmission in terms of

1) Data rate :- Data rate is defined as the ~~space~~ time to transmit data from one device to another.

For a small scale transmission of the data rate is fast as compared to the large scale.

2) Throughput - It is defined as the minimum ~~scale~~ required to transmit data from one device to another device in a network.

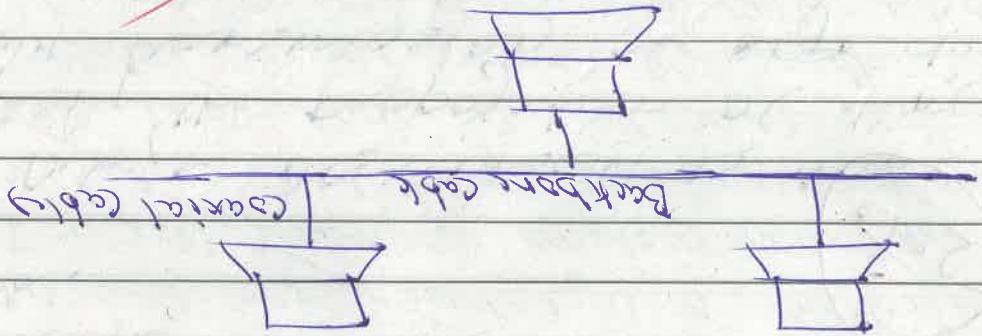
3) Propagation Delay :- Also known as time delay, It is used to identify the propagation of time delay between the successful transmission of ~~space~~ data from one computer network to another computer network in terms of time

4) Bandwidth :- Bandwidth defines the range required for successful transmission of data from one computer network to another.



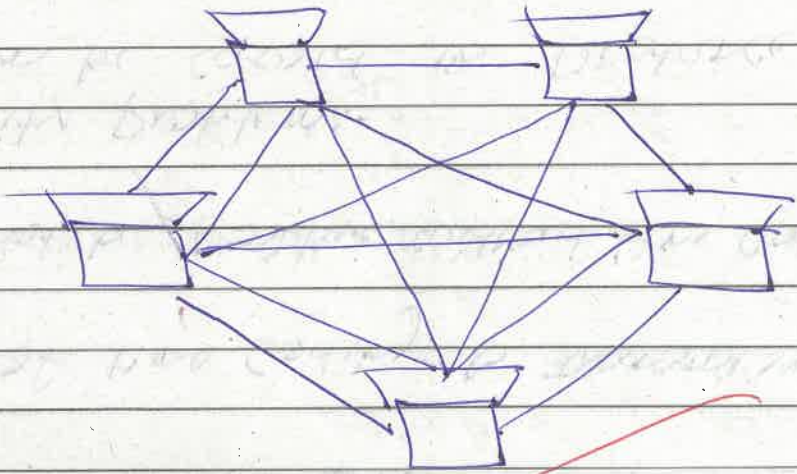
(B) Topology is defined as the way connection between the ~~computer~~ computer devices. The most common used topology of networks are

(i) Bus Topology :- In this topology computer devices are connected through a single wire also known as Backbone cable with the help of coaxial cables. In this topology the data transmission is one directional.



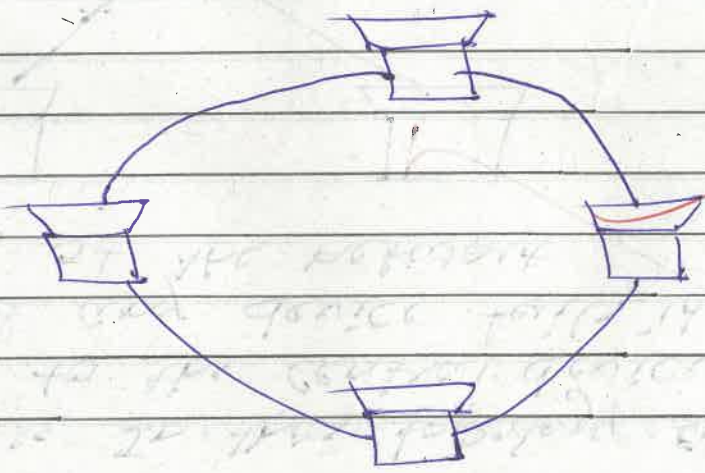
(ii) Ring topology :- In this topology computer devices are connected in a ring like structure and no of links = no. of devices and each device required two ports. If any system in this topology fails. Entire topology fails



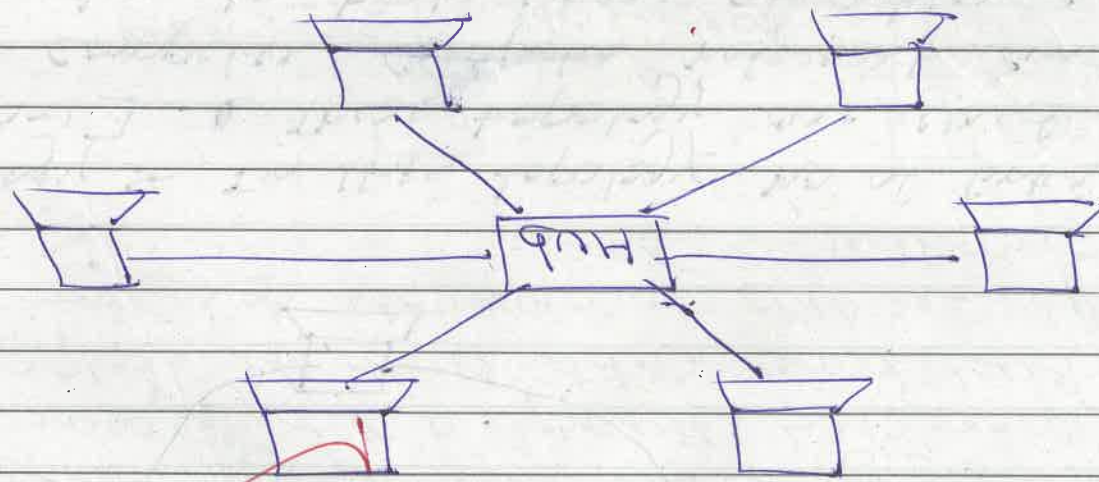


expensive due to high usage of cables and also hard to maintain

Mesh Topology :- In this topology no of links = no of devices  
 $-1 [n \times n - 1]$ . These topology are used in small ~~network~~ computer networks and even



Star Topology :- In this topology every device is connected to the central device called hub. In case of any device fails it doesn't affect other devices of the network.



Part - 2

Ans 1 The Application of line coding is transmission of data.  
Transmission cannot be possible without line coding.

Ans 2 Count to infinity problem:-  
This problem can be caused in Distance vector



Routing algorithm because the count is upto infinity and

Ans 3

Pure ALOHA

Transmission Time = 2T

Probability =  $h \times e^{-2h}$

Efficiency = 18.4%

Slotted ALOHA

Transmission Time = T

Probability =  $h \times e^{-h}$

Efficiency = 36.8%

Ans 4

Bandwidth = 3.4 KHz

WHP = 1000

Capacity = Bandwidth  $\times \log_2(1 + \text{SNR})$

Capacity =  $3.4 \times \log_2(1000)$

2

Ans 5 Data Modulation can be of two types

- (i) Modulation
- (ii) Demodulation

1) Modulation :- Convert the analog signal to digital signal

Demodulation :- Convert the digital signal to analog signal.

~~Demodulation~~





**Theory**



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|------------------|--------------|------------------------|------------------------|---------|---------------------------|

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|-----------------------------------|--|--|--|--|--|--|--|--|--|--------------------------------------|--|--|--|--|--|--|--|--|--|
| Name of Exam...Mid term Exam      |  |  |  |  |  |  |  |  |  | Day & Date...Monday, 10/6/23         |  |  |  |  |  |  |  |  |  |
| Name of Candidate...Sneha Agarwal |  |  |  |  |  |  |  |  |  | College Registration No...PCE22CS155 |  |  |  |  |  |  |  |  |  |
| Name of Subject/Paper...Physics   |  |  |  |  |  |  |  |  |  | Subject/Paper Code...2FV2-02         |  |  |  |  |  |  |  |  |  |
| Signature of Candidate...         |  |  |  |  |  |  |  |  |  | Name & Signature of Invigilator...   |  |  |  |  |  |  |  |  |  |

|                |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |                      |    |                       |
|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----------------------|----|-----------------------|
| Question No.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Maximum Marks        | 60 | Signature of Examiner |
| Marks Obtained | - | 1 | - | 2 | 2 | 5 | 5 | 5 | 5 | -  | -  | -  | 10 | 8  | 10 | Total Marks Obtained | 83 | (No)                  |

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# PART-B.

Q.6

As

$$a) \vec{E} = E_x \hat{i} + E_y \hat{j} + E_z \hat{k}.$$

$$\text{Curl} = \nabla \times \vec{E}$$

$$= \left( \hat{i} \frac{\partial}{\partial x} + \hat{j} \frac{\partial}{\partial y} + \hat{k} \frac{\partial}{\partial z} \right) \times (E_x \hat{i} + E_y \hat{j} + E_z \hat{k})$$

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ E_x & E_y & E_z \end{vmatrix}$$

$$= \hat{i}(0-0) - \hat{j}(0-0) + \hat{k}(0-0)$$

$$= 0.$$

$$\text{div Curl } \vec{E} = \vec{\nabla} \cdot (\text{Curl } \vec{E})$$

$$= 0$$

$$\begin{array}{r} 15 \\ 16 \\ \hline 30 \\ 15 \times \\ \hline 240 \end{array}$$

$$\begin{array}{r} 24 \\ 18 \\ \hline 42 \\ 192 \\ 24 \times \\ \hline 432 \end{array}$$



$$b) \vec{A} = 6x^2y \hat{i} + 10y^2z \hat{j} + 4xz \hat{k}$$

$$\begin{aligned} \text{div}(\vec{A}) &= \vec{\nabla} \cdot \vec{A} \\ &= \left( \hat{i} \frac{\partial}{\partial x} + \hat{j} \frac{\partial}{\partial y} + \hat{k} \frac{\partial}{\partial z} \right) \cdot (6x^2y \hat{i} + 10y^2z \hat{j} + 4xz \hat{k}) \\ &= \left( \frac{\partial}{\partial x} (6x^2y + 10y^2z + 4xz) + \frac{\partial}{\partial y} (6x^2y + 10y^2z + 4xz) + \frac{\partial}{\partial z} (6x^2y + 10y^2z + 4xz) \right) \end{aligned}$$

$$= 12xy + 4z + 6x^2 + 20yz + 10y^2 + 4x$$

$$= 6x^2 + 10y^2 + 4x + 4z + 12xy + 20yz$$

$$(x, y, z) \equiv (0, 0, 1)$$

$$= 6 \times 0^2 + 10 \times 0^2 + 4 \times 0 + 4 \times 1 + 12 \times 0 \times 0 + 20 \times 0 \times 1$$

$$= 0 + 0 + 0 + 4 + 0 + 0$$

$$= 4$$

Q.7

Ans

Given,

$$T = 300 \text{ K}$$

$$\begin{aligned}\sigma &= n_i e (\mu_n + \mu_p) \\ &= 1.5 \times 10^{16} \times 1.6 \times 10^{-19} (0.13 + 0.05) \\ &= 2.4 \times 10^{-3} (0.18) \\ &= 432 \times 10^{-6}\end{aligned}$$

$$\begin{aligned}\mu &= \frac{v}{T^{3/2}} & \mu &= \frac{\sigma}{ne} = 4 \\ &= \frac{432 \times 10^{-6}}{(300)^{3/2}} & &= \end{aligned}$$

Q.8  
Soln

Given,

$$\begin{aligned}\lambda &= 5000 \text{ \AA} \\ &= 5000 \times 10^{-10} \text{ m} = 5 \times 10^{-7}\end{aligned}$$

$$\begin{aligned}r &= \frac{C}{\lambda} = \frac{3 \times 10^6}{5 \times 10^{-7}} \\ &= 0.6 \times 10^{15} \\ &= 6 \times 10^{14}\end{aligned}$$

$$\begin{aligned}\frac{A_{sp}}{B_{st}} &= \frac{8\pi h}{\lambda^3} \\ &= \frac{8 \times 3.14 \times 6.62 \times 10^{-34}}{(5 \times 10^{-7})^3} = \frac{1.6629 \times 10^{-3}}{125 \times 10^{-21}} \\ &= 0.013 \times 10^{18} \\ &= 13 \times 10^{15}\end{aligned}$$

$$A_{sp} = p \frac{h^2}{k_B T}$$

$$\begin{array}{r} 35 \\ 16 \\ \hline 90 \\ 15 \\ \hline 240 \end{array}$$

$$\begin{array}{r} 35 \\ 16 \\ \hline 90 \\ 15 \\ \hline 240 \\ 24 \\ \hline 432 \end{array}$$



Q.9

As Fermi Function :-

$$F(t) = \frac{1}{1 + e^{\left(\frac{E - E_F}{k_B T}\right)}}$$

at  $T = 0K$

For  $E > E_F$

$$2) \frac{E - E_F}{k_B T} = \frac{+ve}{k_B \times 0} = +\infty$$

Hence,

$$F(t) = \frac{1}{1 + e^{(\infty)}}$$

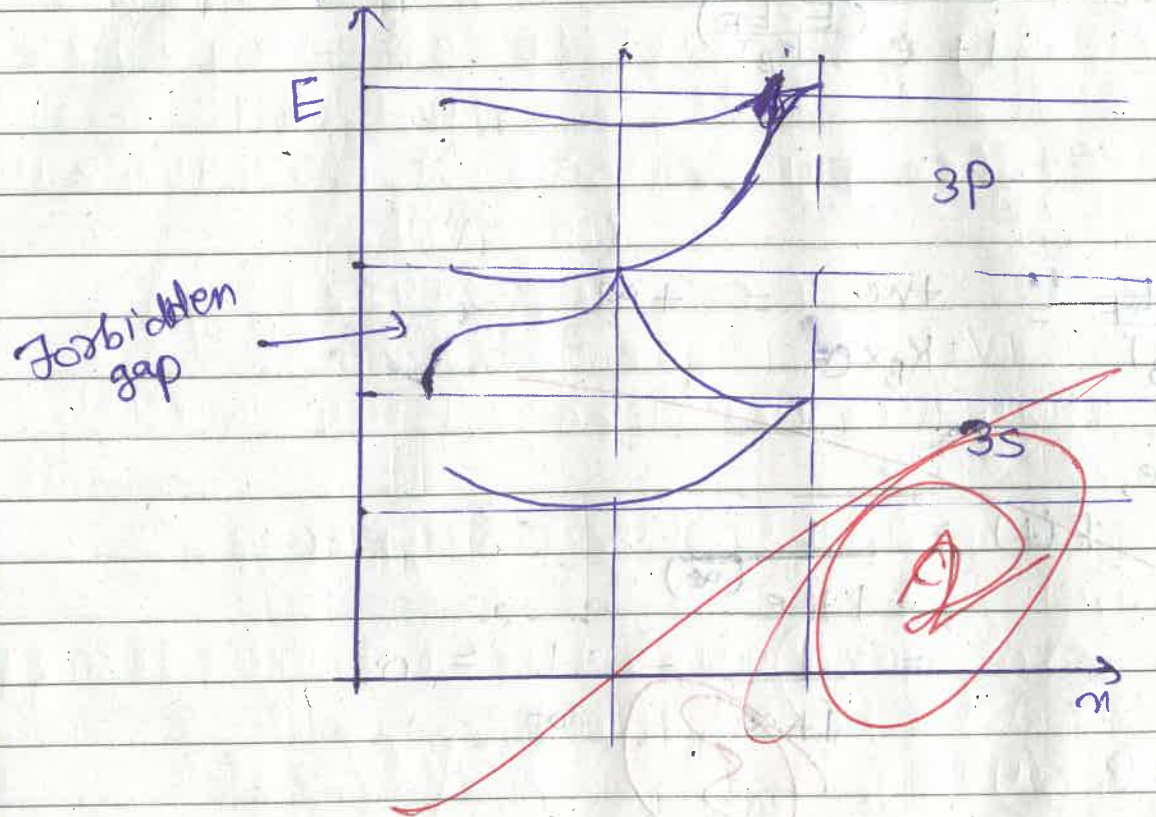
$$= \frac{1}{1 + \infty} = \frac{1}{\infty} = 0.$$

3

## PART A

Q.2.

Ans Energy band structure :-



Q.4

Ans Fermi Energy :-

Probability of occupancy of electrons in energy gap :-

$$\begin{array}{r} 3 \\ 15 \\ 16 \\ \hline 30 \\ 15 \times \\ \hline 240 \end{array}$$

$$\begin{array}{r} 3 \\ 24 \\ 18 \\ \hline 192 \\ 24 \times \\ \hline 432 \end{array}$$

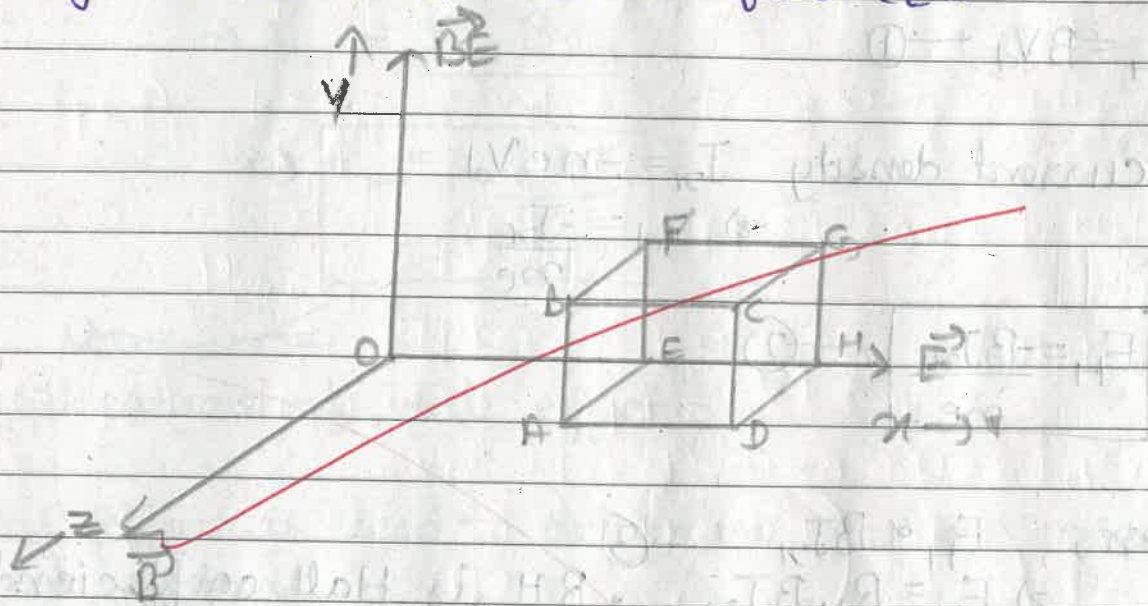


Fr. of Be.V. (Larentia fovea)

Q.13

### What is Hall effect:-

When a conductor (semiconductor or metal) is placed in a transverse magnetic field, the current will induce in  $y$  region and the normal of conductor is perpendicular to magnetic ( $B$ ) and electric field ( $E$ ).



When n-type semiconductor is placed in magnetic field then a force is observed and when p-type placed force is observed.

As for n type force is in  $-x$  direction and p-type

$$F_H = BeV_d \quad (\text{Lorentz force})$$

$$F_H = eE_H$$

$$BeV_d = eE_H$$

$$E_H = BV_d \quad \text{--- (1)}$$

$$\therefore \text{current density } J_x = -neV_d$$

$$\Rightarrow V_d = \frac{-J_x}{ne}$$

$$\Rightarrow \boxed{E_H = \frac{-BJ_x}{ne}} \quad \text{--- (2)}$$

$$\text{Here, } E_H \propto BJ_x \quad \text{--- (3)}$$

$$\Rightarrow E_H = R_H BJ_x, \quad R_H \text{ is Hall coefficient}$$

Comparing eq. (2) and (3)

$$\Rightarrow \boxed{R_H = \frac{-1}{ne} = \frac{1}{\rho}} \rightarrow \text{charge density}$$

$$\begin{array}{r} 3 \\ 15 \\ 16 \\ \hline 30 \\ 15 \times \\ \hline 240 \end{array}$$

$$\begin{array}{r} 34 \\ 24 \\ 18 \\ \hline 192 \\ 24 \times \\ \hline 432 \end{array}$$



and  $J_x$  current density =  $\frac{I_x}{Wd}$

From eq. (9)

$$\Rightarrow V_H = R_H B \frac{I_x}{Wd} \times d$$

$$\Rightarrow V_H = \frac{R_H B I_x}{W}$$

$$\Rightarrow R_H = \frac{V_H W}{B I_x}$$

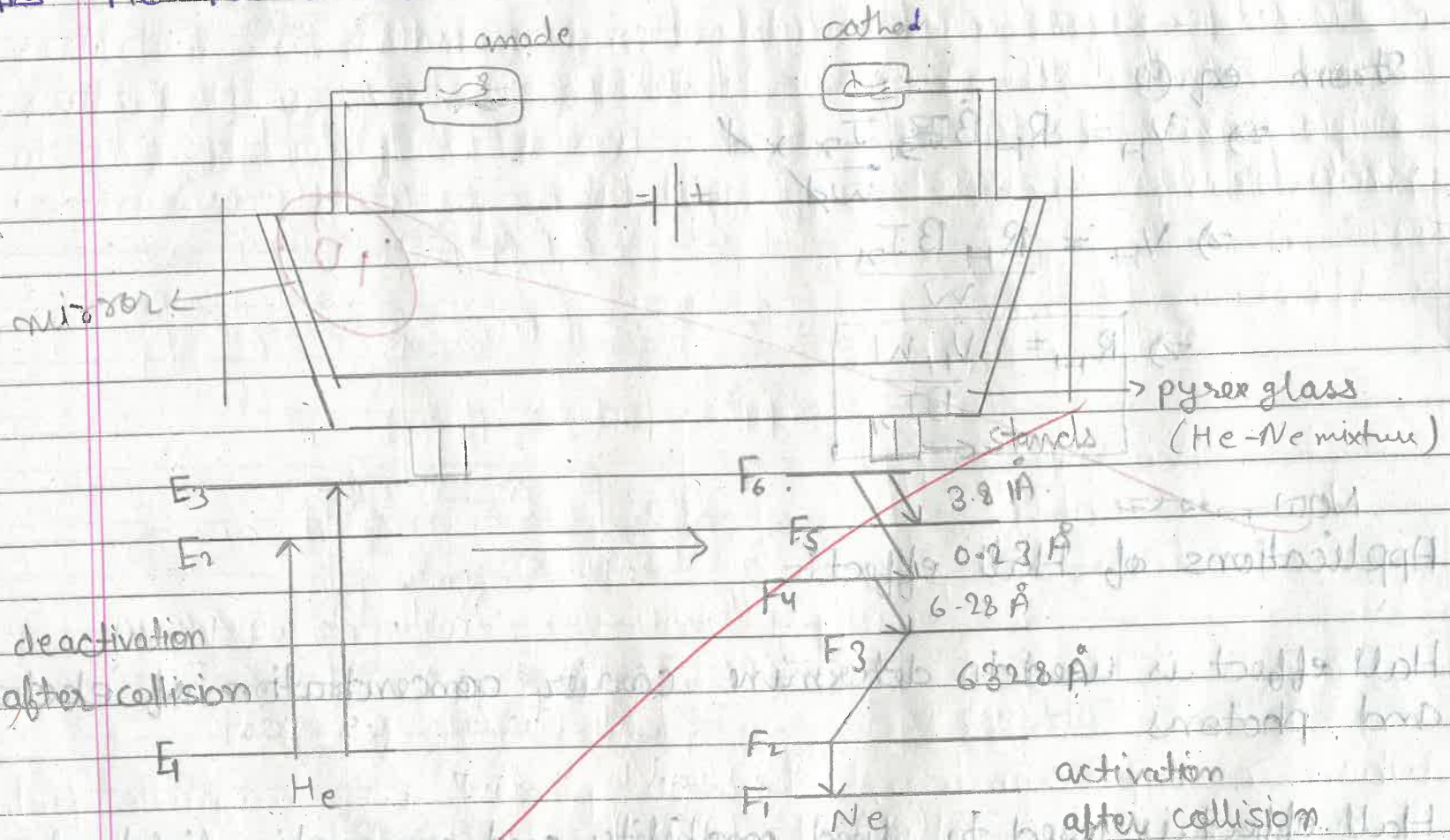
~~Now we~~

Applications of Hall effect:-

- Hall effect is used to determine carrier concentration of electrons and photons
- Hall effect is used to find mobility and magnetic field also
- Hall effect is also used to find electro-magnetic current

Q.14

Ans He-Ne Laser:-



Construction:-



has a wavelength of  $6328\text{\AA}$  ideally. He and Ne Laser is a apparatus ~~with~~ with optical bench, optical screen, He-Ne laser source, etc. So this is the information about the construction of He-Ne laser.

Working:-

He-Ne Laser works as Ne has excitation energy level at  $F_6$  and He has at  $E_2$  and  $E_4$ . When the current discharged through the source, it will excite He elements for excitation but Ne stays deactivated. He in a excited state helps or works to excite Ne elements and after the condition of achieving population inversion (means maximum atoms or elements are in excited state is population inversion) Ne starts to emit energy or photon after reaching  $F_3$  it starts emitting spontaneously means photons of same frequency gets emitted and come down again to ground level it has 4 element and inherent in nature.

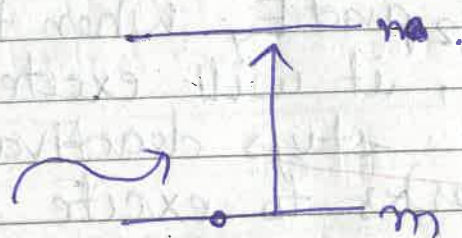
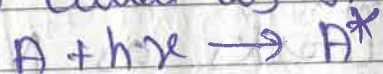
For He-Ne laser experiment,  $A_{sp}/B_{st}$  ratio should be greater  
→ ~~then~~ Role of He in this laser:-  
He has 4 elements and Ne has 4 elements and should be in times laser



Q.15

Ans a) Absorption:-

When an electron absorbs a photon or energy in its energy level, it gets excited and moves towards higher energy level, this phenomenon is absorption; Also called as induced and stimulated absorption.



$$E_n - E_m = h\nu$$

$$R_{ab} \propto U(\nu) \quad \text{--- (1)}$$

$N_m \rightarrow$  No. of atoms per unit volume.

$$R_{ab} \propto N_m \quad \text{--- (2)}$$

From eq. (1) and (2)

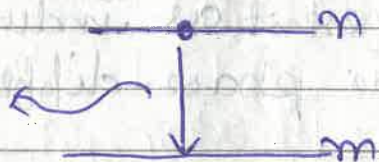
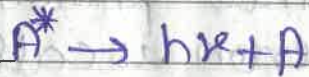
$$R_{ab} \propto N_m U(\nu)$$

$$R_{ab} = B_{ab} N_m U(\nu)$$



b) Spontaneous:-

When an  $e^-$  or a atom emits energy from its higher energy level and comes or transfers to below energy level. This phenomenon is called as Spontaneous emission.



$$\frac{E_n - E_m}{h} = \nu$$

Here,

$$R_{sp} \propto N_m$$

$N_m$  is No. of atoms per unit volume.

$$R_{sp} = A_{sp} N_m \quad \text{--- (1)}$$

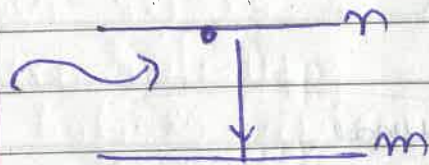
Where  $A_s$  is the spontaneous einstein coefficient

The rate of change is

$$R_{sp} = -\frac{dN_m}{dt} = \frac{N_m}{T_c} \quad \text{--- (2)}$$

c) Stimulated emission:-

When an electron ~~is~~ absorbs photon, it transgress from lower to higher energy level but when an photon come in contact with atom already in higher state, it emits photon of same frequency by inducing. This phenomenon is called stimulated emission, and this phenomenon is coherent as induced photon and reacting photon has same phase difference.



$$E_n - E_m = h\nu$$

$$R_{st} \propto U(\nu) \quad \text{--- (1)}$$

$N_n \rightarrow$  No. of atoms per unit volume.

$$R_{st} \propto N_n \quad \text{--- (2)}$$

eq. 1 & 2

$$\Rightarrow R_{st} \propto U(\nu) \cdot N_n$$

$$\Rightarrow R_{st} = B_{st} \cdot U(\nu) \cdot N(n)$$



Relation between Einstein coefficient.

$$R_{ab} = R_{sp} + R_{st}$$

$$2) N_m u(x) B_{ab} = N_m \cancel{A_{sp}} A_{sp} + N_m (u(x)) B_{st}$$

$$2) N_m u(x) B_{ab} = N_m A_{sp} + N_m u(x) B_{st}$$

$$2) N_m u(x) B_{ab} - N_m u(x) B_{st} = N_m A_{sp}$$

$$2) u(x) = \frac{N_m A_{sp}}{N_m B_{ab} - N_m B_{st}}$$

$$= \frac{A_{sp}}{\frac{N_m}{N_m} B_{ab} - B_{st}} \quad \text{--- (1)}$$

Now;

$$\frac{N_m}{N_m} = \frac{N_0 e^{\frac{E_m}{k_B T}}}{N_0 e^{\frac{E_n}{k_B T}}}$$

$(E_m - E_n)$

$h\nu/k_B T$

$$\Rightarrow u(x) = \frac{A_{sp}}{B_{ab} \left( e^{hx/k_B T} - \frac{B_{st}}{B_{ab}} \right)}$$

Planck's reaction:-

$$2) \quad = \frac{8\pi h x^3 e^3}{c^3} \left( e^{hx/k_B T} - 1 \right)$$

On comparing

$$2) \quad \frac{A_{sp}}{B_{ab}} = \frac{8\pi h x^3 e^3}{c^3}$$

$$2) \quad \frac{1}{\tau_c \cdot B_{ab}} = \frac{8\pi h x^3 e^3}{c^3}$$

$$\therefore A_{sp} = \frac{1}{\tau_c}$$

$$\frac{B_{st}}{B_{ab}} = 1$$

$$2) \quad B_{st} = B_{ab}$$

$$2) \quad B_{ab} = \frac{c^3}{8\pi h x^3 e^3 \tau_c}$$



Q.4 at  $T=0K$ .

$$E > E_F$$

$$\frac{E - E_F}{k_B T} = \frac{+\infty}{k_B \times 0} = +\infty$$

$$= \frac{1}{1 + e^{\infty}} = \frac{1}{\infty} = 0$$

$$E < E_F$$

$$\frac{E - E_F}{k_B T} = \frac{-\infty}{k_B \times 0} = -\infty$$

$$= \frac{1}{1 + e^{-\infty}} = 1$$

at  $T > 0K$ ,

$$E = E_F$$

$$\Rightarrow \frac{E - E_F}{k_B T} = 0$$

$$F(E) = \frac{1}{1 + e^0} = \frac{1}{2} = 0.5$$

Q.5

Ans Curl  $\vec{r} =$   
 $\text{curl } \vec{r} = \vec{0}$

b) Divergence :-

$$\text{Div}(\vec{F}) = \nabla \cdot \vec{F}$$

$$= \left( \hat{i} \frac{\partial}{\partial x} + \hat{j} \frac{\partial}{\partial y} + \hat{k} \frac{\partial}{\partial z} \right) \cdot (F_x \hat{i} + F_y \hat{j} + F_z \hat{k})$$

$$= \left( \frac{\partial}{\partial x} F_x + \frac{\partial}{\partial y} F_y + \frac{\partial}{\partial z} F_z \right)$$