Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Water Resources Management

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain Hydrologic cycle, with a neat sketch. (08 Marks)
b. Explain briefly Indian Water Resources. (08 Marks)

OR

2 a. What is meant by Water scarcity? Discuss reasons for water scarcity problems. (08 Marks)
b. Explain different types of aquifers. Also explain the different water bearing formations (08 Marks)

Module-2

3 a. State the necessity of Water Resources Planning and Management. (08 Marks)
b. Explain system components used in Water Resource Planning (08 Marks)

OR

4 a. Discuss Planning and Management aspects. (08 Marks)
b. Explain approaches used in Water Resource Planning. (04 Marks)
c. Explain Post Planning and Management Issues. (04 Marks)

Module-3

5 a. Define IWRM. Mention Dublin principles of IWRM. (08 Marks)
b. Explain process of Implementation of IWRM. (08 Marks)

OR

6 a. Explain Legislative and Organizational Frame work in IWRM. (08 Marks)
b. Discuss types and forms of Private Sector involvement in IWRM (08 Marks)

Module-4

7 a. What is meant by Water Governance? State the need of Water Governance. (08 Marks)
b. Mention the necessity of National Water Law. (08 Marks)

OR

8 a. Explain salient features of National Water Policy 2012. (08 Marks)
b. Explain Irrigation Management Transfer policies and activities. (08 Marks)

Module-5

9 a. Explain briefly any two Rain water Harvesting Techniques. (08 Marks)
b. Explain Micro – Catchments Rain water Harvesting. (08 Marks)

OR

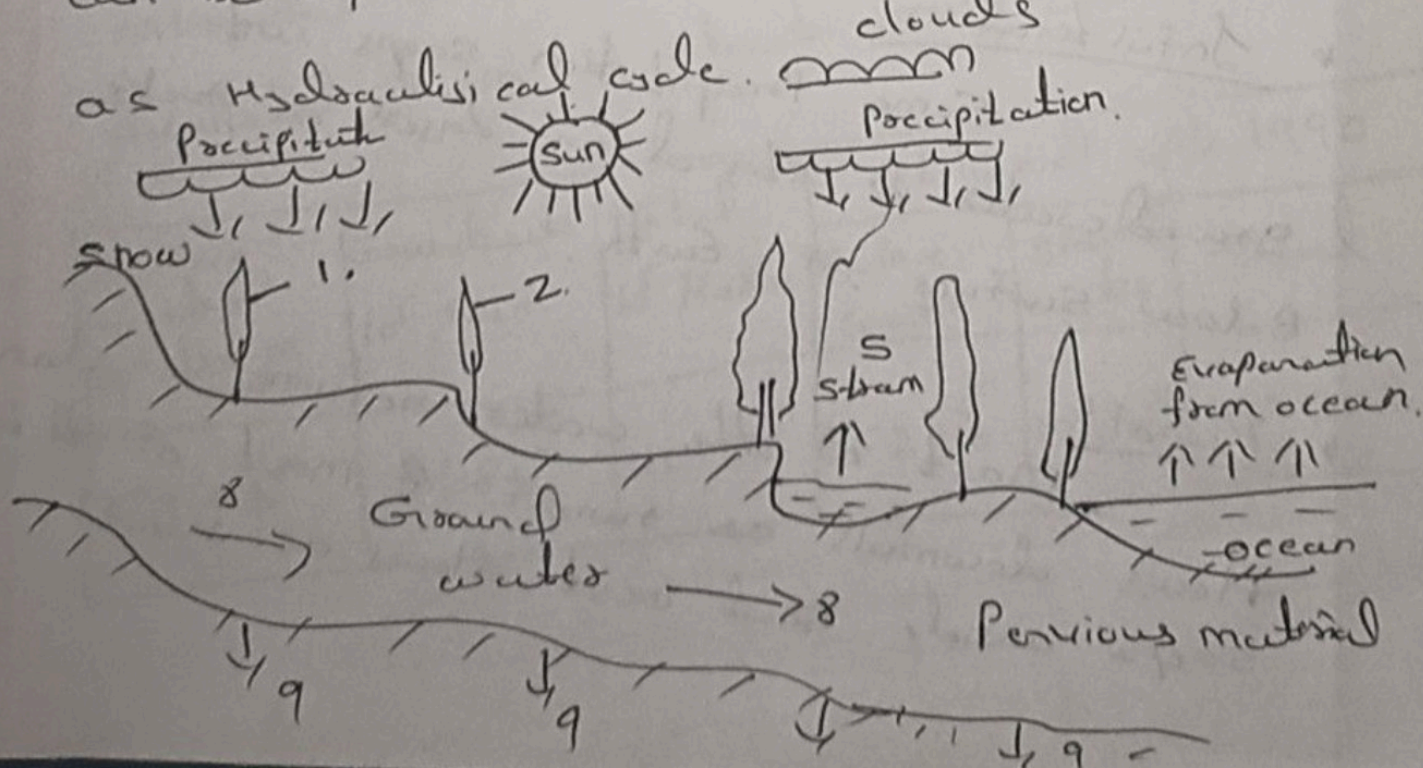
10 a. Explain design steps for percolation Tank in RWH. (08 Marks)
b. List and explain the factors influencing Yield from a catchment (08 Marks)

Solution for VTU Question Paper.

Subject - Remote Water Resource Management
Semester - 6 [Parallel subject]
Code - 15CV661/17CV661
Max marks - 80

Q1 ⇒ Hydrological cycle.

Water occours on earth in all 3 states via. liquid solid & gases in various degree of motion. Evaporation of water from water Bodies such as oceans & lakes, formation & movement of clouds rain & snowfall, streamflow & groundwater movement are some examples of dynamic aspects of water. The various aspects of water related to Earth can be explained in terms of cycle known as Hydrological cycle.



0. Evaporation from ocean
1. Raindrop Evaporation.
2. Interpiration
3. Transpiration.
4. Evaporation from land
5. Evaporation from water Bodies
6. Surface runoff
7. Infiltration
8. Ground water
9. Deep Percolation.

Hydrological cycle.

* **Evaporation**
Water is transferred from surface to atmosphere through evaporation the process by which water chages from liquid to gas.

* **Transpiration**
Process of water loss from plants

* **Condensation**
water vapour changes into water

* **Precipitation**
when water in clouds get too heavy water falls Back to Earth in many forms.

* **Infiltration**
Some Precipitation seeps into groundwater & stored in layers of rocks Below surface of Earth.

* **Runoff**
most of the water returns to land flows downhill as runoff. & most of it seeps inside soil rest flows as runoff.

1b) Indian water Resources.

* India with a geographical area 329 million hectors is blessed with large river Basins which have divided into 12 major & 45 medium river basins comprising 252.8 mha & 24.9 mha of total catchment area respectively. It posses about 4% of the total annual runoff of the rivers of the world.
* The Per capita water availibity of natural runoff is only 2200 cubic meter per year.
* Annual Percipitation in country is estimated about 4000 cubic km. This amount includes snow preciptation as well.
* more than 80-90% annual runoff occurs during monsoon months. Because of this it is estimated that avg annual potential of water availabel India is about 1869 cubic km.

Surface water 10^5 Ha-m	Groundwater 10^5 Ham	Total 10^5 Ha-m	utilized upto 1990		
			Surface water	ground water	Total
69.03	41.85	110.88	36.2×10^5	19.0×10^5	55.2×10^5

2.a) Water scarcity.

Water scarcity is either the lack of enough water (quantity) or lack of access to safe water.

It currently affects around 2.8 billion people around the world on all continents, atleast one month out of every year & more than 1.2 billion people lack the access to clean drinking water.

Causes / Reasons

* Demand & usage.
  → 3% of rural population lack access to drinking water.
  → 90% Agriculture water is used
  → Industrial - water in important input.
* Supply.
  Surface water - 48% rainfall ends up in Indian rivers.
  only 18% can be used.
* climate change.
* Population. - growing population increase demand
* Pollution
  Polluted water seeps into the groundwater can contaminate agricultural products when used for irrigation.

2.b Aquifers

There are mainly Two types
1) Unconfined Aquifers
2) Confined Aquifers.

Unconfined Aquifers →
An aquifer having a water table in it is called unconfined aquifers. Here water Tabel serves as upper surface of zone of saturation while Less permeable or Impermeable layer defins its lower boundary.

Confined Aquifers.
when aquifer is saturated b/w two layer of much less Permeable material it is called Confined Aquifers. Als known as Pressur aquifer. These are completely filled with water & they do not have free water Table.
4 different Types of geological formations of ground water.

* Aquifer – Saturated formation of Earth
* Aquitard – It Permits water thrgh it But does not yield water as aquifer.
* Aquiclude – It is Impermeable to the flow of water
* Aquifuge → It is Impermeable geological formation which is neither Porous nor Permeable ie Cannot store water.

3a Necessity or Need for Planning & Management.

* Planning & management of water Resource System are essential due to following reasons.

* Severity of adverse consequences of droughts floods & excessive pollution. These can lead to

a) Too little water due to growing urbization.

b) Too much water due to Increased flood frequencies & also in increase in water demands

c) Polluted water due to Both Industry & household discharges.

d) sediment accumulation in the reservoir due to poor water quality.

Considering all th factors the identification & Evaluation of alternative measures that may Increase quantitative & qualitative System performances in th primary goal of planning & management process.

Hence it becomes very necessary planning & management.

3b System Components used in water Resource Planning. (7)

Water Resource management involves the interaction of three interdependent subsystems.

a) Natural rivers subsystem

Here the physical chemical Biological Process Takes place.

b) Socio Economic subsystem

This includes the human activities related to the use of the natural rivers system.

c) Administrative & Institutional subsystem

This Includes of administration legislation & regulation where the decision planning & management process takes place.

Inadequate attention to one subsystem can reduce the effect of any work done to improve the performance of the others.

Every subsystem is interrelated to Each other & any one failure can lead to many troubles in other systems.

4.a) Planning & Management Aspects.

Technical Aspect

It is first necessary to identify characteristics of resource in that Basin, including the land, rainfall, runoff, stream & rivers flows & the ground water planning involves.

* Predicting changes in land use.
* Economic activity at watershed & rivers Basin.
* There will influence amount of runoff, & Concentration of sediment & quality of Construction.

Economic & Financial Aspect

* Water should be treated as an economic commodity to extract the maximum benifits as well as to generate funds to recover the costs of the investment & of the operation & mainstainance of system.
* Cost of recovery as needed to recover the construction costs, if any & to maintain, repair & operate an infrastructure designed to manage the Basins.

Institutional Aspects

* The first condition for successfull project Implimentation is to have an enabling environment.

* These must exist natural, provincial & local policies, legislations & institutions that make it possible for right decisions to be taken & implemented correctly.

4b) Approaches used in planning & management

Two approaches are.

* From the top down or command & control approach
* From bottom up or grass root approach.

Top down approach

Water resource professionals prepare integrated multipurpose master development plans with alternative structural & non structural management options. There is dominance of professionals & a little participation of stake holders.

Bottom up approach

In this approach there is active participation of interested stake holders those affected by management of water & land measures. plans are being created from the Bottom up rather than Top down.

4c) Post planning Management Issues.

once a plan or strategy is produced a Common implimentation issues include.

→ How are the impacts resulting from the implimentation of any decision going to be monitored assessed & modified as desired?

→ who will keep stake holders informed?

→ who will keep the plan?

→ How often should plans & their database be updated?

→ How can new projects be operated in ways that increase the efficiencies & effectiveness of joint operation of multiple projects in water shed of river Basins - rather than each project being operated independently of others.

These questions should be asked & answered atleast in general terms before the water resource planning & management begins.

5. a) IWRM - It is the process which promotes the co-ordinate development & management of water lands & other shores in order to maximise economic & social welfare in an equitable manner without compromising vital ecosystem & environment sustainability.

Principles - Dublin

A meeting held at Dublin in 1992 by the Technical ammitte of global water Patnership four principles laid are.

1) Fresh water is finite & vulnerable resource essential to sustain life development
2) Water development & management should be based on participant approach involving wese planner & policymakes at all levels.
3) Participatry approach - water is a subject in which everyone is a stakholder.
4) Water has an Economic value in all its competing uses & should be recognized as an Economic good.

5b Implimentation of IWRM

(v) IWRM aims to coordinate development & the management of water LAN & related resource to maximise equitable Economic & social welfare without damaging vital Eco system.

(w) The panel will focus on the practice Science & Policy (PSP) & how it can be strengthened through co-design of research & solution prespective of sustainable development goals..

(x) The session will focus on how sharing availabel information knowledge & action as well as valuable instruments & approaches can contribute to Implimentation of sustainable development goals.

Experts, Decision makers, stake holders play a vital role in giving the Inputs for Better Implimentation of IWRM- Integrated water Resource management.

6. a) Legislative & organizational framework IWRM

Legislative framework

* The main purpose of legislative is to create an enabling environment for IWRM platform with appropriate policy & legal framework.

(i) Legislative framework means involving or relating to process of making, designing & passing laws.

(ii) Bringing some of the principles of IWRM into water sector policy & achieving political support as hard decisions to have been made.

(iii) ∴ it is not appraising that major legal & institutional reforms are unlikely to take place until serious problems experienced.

characteristics

* The act has to be farmer friendly
* Water legislative policies to Low.
* clarifies the entitlement & responsibilities of user & water provided.

organizational framework

(v) The ultimate goal of the management process is to allocate water in quality & quantity Terms for different process.

(v) The process involves resource assesment, planny decision making implimentation & polig allocation & use of watg resource Based on it interest of ~~st~~ stakeholders.

* The activities are highly multidiciplinary involvig Engineers in Hydrolgy. Hydraulics, construction of water supply, sanitation, hydropower station Ecnomic, social, Agriculturst etc.

6b) Types & Forms of Private sector Involvement

* Forms → Full Divestment
→ Partial "
→ Concession
→ Leasg
→ BoT/Boo
→ Service management
→ Contract "

* Divestmment
→ It is the transfer or ownership wrt the infrastructure assest into private handh as well as gaving the responsibilig to private companies for operation maintainance revenue raising & investment.

* Concession
→ Under concession the sector assets formally remain public property.
→ Private Companies has Large usage over the assest & has complete responsibilig for tasks.

C) Lease

* They are normally competitively less, because of their limited scope. they are usually simplies to regulate concession & Investment.

D) BOT & BOO

* The main aim of their form is to attract the privately investment into construction of new infrastructure.
* BOO is all about construction, maintainance investment, Benifits etc.

E) Management

* These are the potentially most amptitude forms of privatisation & Improve the least regulatory Burden.
* In case of management contract the private sector is only responsible for operation & maintainance.
* where as service contract are to be specific criteria.
  Eg Installation of meter, electric supplies

7) Water governance refers to political, social, economical & administrative systems that influence water use & management.
→ Essentially who gets what water when & how & who has the right to water and related services & their benifits.
It determines the equity & efficiency in water resource & services allocation and distribution & Balance water use Between Socio-Economic activities & eco-system.

→ Need of water governance.

→ Existing groundwater rights are under totally land owners region.

→ There is no limit to the volume of groundwater a landowner may draw

→ In such a legal framework only landowners can own groundwater in India.

→ All landless tribals who may have Community rights over land but not Private ownership.

→ Rich landlords can openly selling as much water as they wish.

7b Need for National Water Policy.

* Water is a Prime natural resource a Basic human need and a precious national assest planning & development resource need to be governed by national Perspectives.
* India has more than 18% of worlds Population But has only
  → 4% of Renewable water Resource.
  → 2.4% of land area.
* There are further limits on utilizable quantities of water owing to uneven distribution over time & space.
* In addition there are challenges of flood & draught growing Population rising need, climate change, mismanagement & waste.
* water like air, is one of the most Basic requirements for Life. If a national Law is considered necessary on subjects such as environment forests, wildlife, Biological diversity etc. a national water Law is even more neccesary.

8a National water Policy - 2012.

National water policy is formulated by ministry of water resource of the government of India, to govern planning & development of water resource & their optimum utilization.

1) The proposed National water law is not intended to centralize water management or to change the center state relations in any way. It is a framework of law like an umbrella statement of general principles governing the Exersie of legislative or executive powers by center.

2) The law is to be Justiciable in the sense that the laws passed & the executive actions taken by the center & state government & the developed functions are exercised in the nation. Any deviation from this can be challanged in a court of law.

3) No administrative machinary or institutional structure is predicting at the center under this framwark hence no penal provision are expected.

9.a Rain water Harvesting Techniques

1) Grass strips

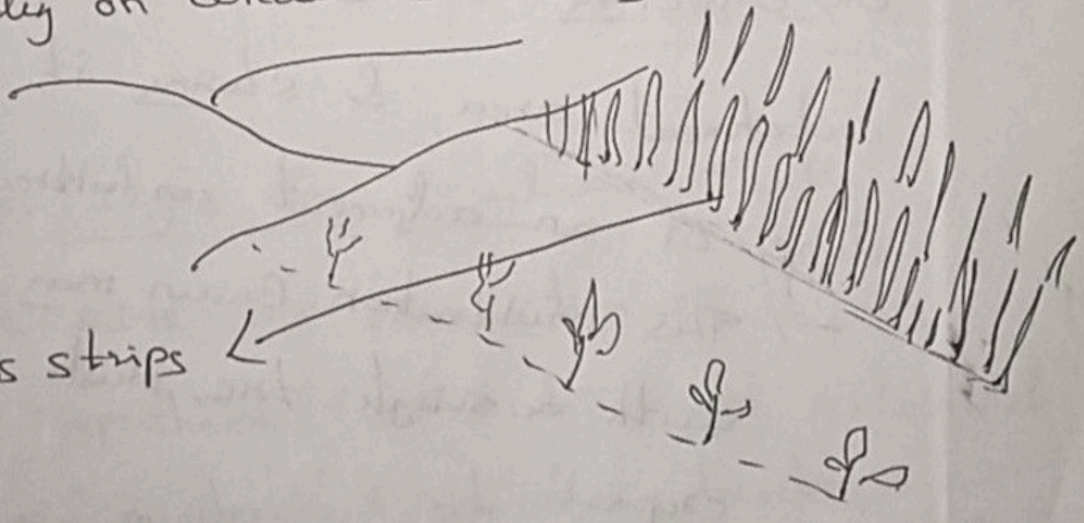
→ strips of grass (up & downside) planted along a contour can reduce soil erosion & run off.

→ silts built up in front of strip & over time benches are formed.

→ on gentle slopes the strips should be widely spaced (20-30cm apart) & on steeper slopes narrowly spaced (10-15m apart)

→ The grass needs to be trimmed regularly to prevent it competing with crops.

→ Varities of grass can be used, depending on what is locally available.



2) Semi Circular Bands

→ Semi circular bands are earth bunds formed in U-shaped on a slope.

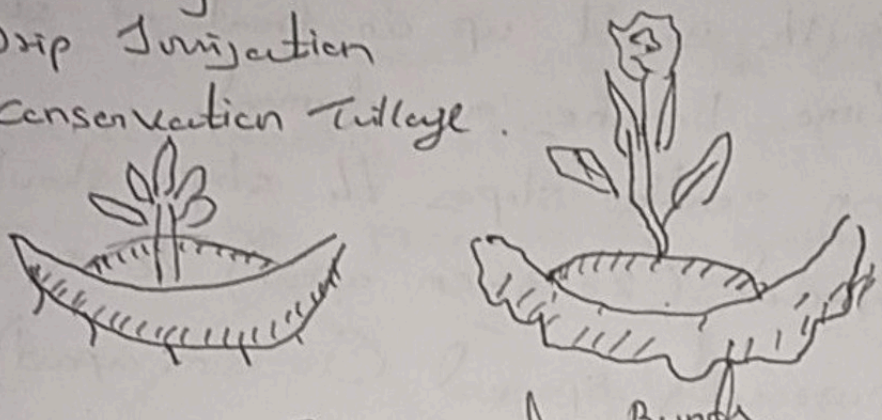
→ The uppermost tips of the 'U' lie on a contour so that runoff is collected

in the lowest selection of the 16.

→ A shallow pit is sometimes also dug in this selection to help moisture.

other methods.

→ Cover crops
→ Mulching
→ Drip Irrigation
→ Conservation Tillage.



Semicircular Bunds.

ab Micro catchments Rain water Harvesting

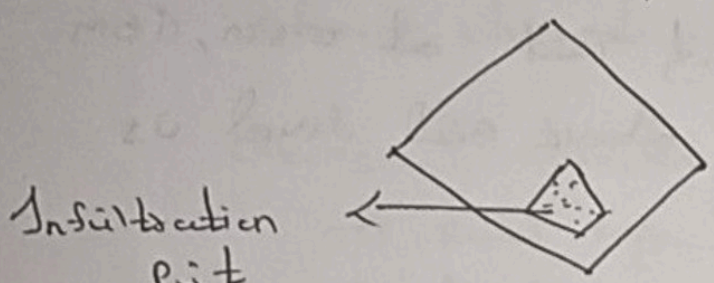
Micro catchment water harvesting is a method of collecting surface runoff from a small catchment area & storing it in the root zone of an adjacent infiltration Basin.

→ This infiltration Basin may be planted with a single tree, Bush or with annual crops.

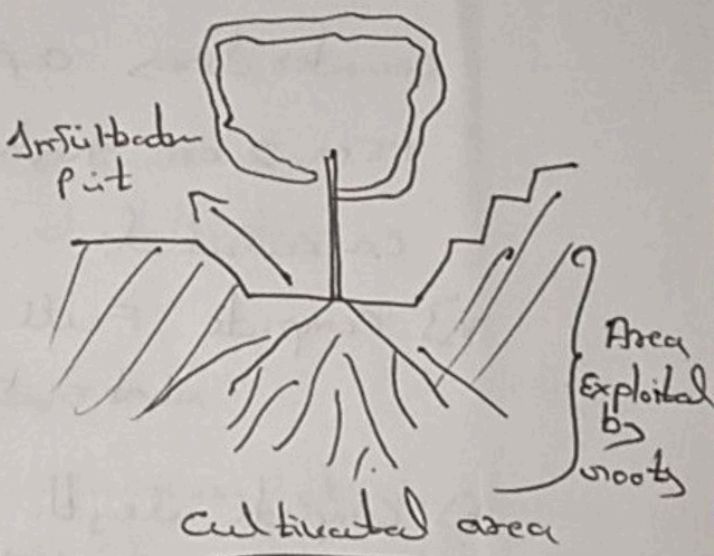
→ The use of microcatchment as a water harvesting method greatly increases crop productivity & have been for thousand of years.

9b Technical characteristics

→ overland flow harvested from short catchment length.
→ catchment length usually Between 1 & 30
→ Runoff is stored in soil profile
→ Ratio of catchment area to cultivated area is usually 1:1 to 3:1
→ There is no provision for overflow.



micro catchment unit



Cultivated area

10a Design steps for Percolation Tank.

1) select site for percolation Tank
2) From Toposheet find out correct catchment area of watershed at that location
3) Compute catchment yield from rainfall & runoff co-efficient.
4) Make suitable assumption.

Assumption such as number of fillings per year, Utilization of yield per filling etc.

Hence Compute capacity of Percolation Tank.

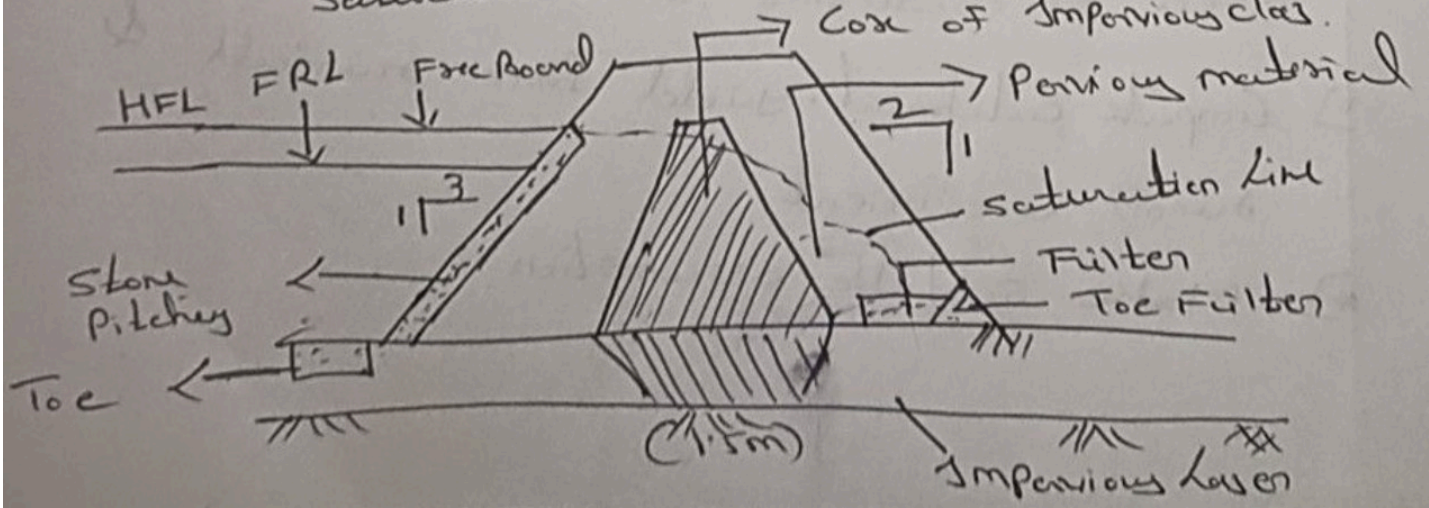
4) Development of storage capacity curve/Table.

Draw counter lines at every 50cm interval Between the Bed Level & the highest ground level at site. From these Counter lines capacity Tank at 0.5m, 1.0m 1.5m, 2.0m hight above Bed level is calculated.

5) Compute Full tank Level from stage.

$$FTL = \frac{H}{5} + 1.5$$

6) Compute depth of embankment
7) Assign suitable slope.
8) Compute Peak discharge
9) Compute depth of spillway
10) Compute width of horizontal floor
11) check suitability of structure by locating Saturation line on the Base



10b Factor affecting Yield catchment

1) Precipitation characteristics
2) shape & size of catement
3) Topography
4) Geobsical characteristics
5) metrological characteristics
6) character of catchment surface.
7) storage characteristics.

Geological characteristics such as
→ soil type & characteristics
→ Vegetation
→ slope of drainage area
→ Ponds, lakes, reserviours etc in Basin which prevent or delay runoff from continuing downstream.

8) Land use activities
→ Development & urbanization
→ Agriculture Practice.