QUESTION NO. 1

DESALINATION:

Process of removal of dissolved salts and other minerals from the saline water to make it fit for drinking, irrigation and industrial utilization.

METHOD OF DESALINATION:

1. **Natural Desalination:**
   Saline water naturally desalinate by following process.
   Evaporation → Condensation → Precipitation → Collection

2. **Distillation:**
   Saline water is heated to make the water to evaporate leaving salts behind. Water vapors free from salts minerals are condensed in a separate container. This method is very costly and time consuming. Not recommended for water supply.

3. **Electro dialysis:**
   Electro dialysis utilize a membrane and sends an electric charge through the solution. It draws metal ions to the positive plate on one side and other ions like salt to the negative plate on the other side. Mostly used in industries.

4. **Freezing method:**
   Water excludes salts when it crystalize to ice. It involves three steps.
   i. Ice formation
   ii. Ice washing
   iii. Ice melting
   It gives us fresh water.

5. **Reverse Osmosis (RO):**
   Water purification technology used for water supply system that uses a semi permeable membrane to remove ions, molecules and larger particles from water. Reverse osmosis can remove many types of dissolved and suspended particles from water including bacteria. This process is used in industries and municipal areas.
   a) In 1st step sediments from water like clay, silt, stones are removed by using 5 micron filter.
   b) In 2nd step carbon filter is used to remove chlorine and other harmful chemicals.
   c) In 3rd step water is passed on dense carbon filter and most of contamination are removed.
   d) In 4th step water is passed through membrane and all heavy metals are removed while fresh water is collected in tank.
   e) In 5th step bacteria, chlorine and bad/foul odor is removed.

MOST EMPLOYED/ FEASIBLE METHOD:

Among the five (05) methods, Reverse Osmosis (RO) method is most feasible and favorable due to purification on large scale in a short time while limited space and less capital is required.

QUESTION NO. 2

There are four (04) layouts of distribution system in water supply schemes.

1. Dead End System
2. Radial System
3. Grid Iron System
4. Ring System

Merits and de-merits are listed below.

S. NO.	TYPE	MERITS	DE-MERITS
1.	**Dead End System**	1. Used in old towns and cities having advantage of determination of discharge (Q) and pressure (P) easier due to less number of valves. 2. Having less cost of design and implementation.	1. Due to many dead ends stagnation of water occurs in pipes which may cause contamination. 2. Due to dead end the water supply circulation cannot be break down of one system
2.	**Radial System**	It gives quick service and no stagnation of water	Having high design and operational cost due to construction of heavy structure
3.	**Grid System**	1. Suitable for cities with rectangular layout which keeps water in circulation due to no dead end. 2. In case of break down in some section water may get available from some other direction.	1. Needs proper designing and capital for implementation. 2. Trained operational staff and valves system is required for its operation.
4.	**Ring System**	1. Determination of size of pipe is easy. 2. No. water stagnancy and quality of water remains fresh.	1. Needs proper layout and built up area having routes for installation of pipes. 2. Needs huge capital for design and construction while operation needs trained staff.

In my opinion in hilly areas having high levels and frequent undulations the best system would be the combination of Grid system to cover the over all area and the providing dead ends in streets and small clusters due to the fact that in a village on hilly area the only grid system may not be properly managed as pressure at various nodes even in streets may not give consistent values while the introduction of dead end may enhance the availability of consumer end pressure and availability of proper flow even the system is halted for repair at few sections.

QUESTION NO. 3:

TYPES OF RESERVOIRS:

Two major types based on construction are as under.

1. **SURFACE RESERVOIR**
2. **ELEVATED / OVER HEAD RESERVOIR**

Characteristic importance of both kinds of reservoirs are listed below.

S. No.	SURFACE RESERVOIR	ELEVATED / OVER HEAD RESERVOIR
1.	Constructed on ground surface or underground.	Constructed at an elevation.
2.	Mostly circular or rectangular.	Circular, rectangular and cylindrical shapes supported by column beam-structures or constructed on high level hill top plane area.
3.	Mostly made of stores bricks in combination of RCC core walls.	These are the RCC structures which can withstand earthquake and wind loads due to high elevation.
4.	Manholes for entrance, cleaning are provided. Proper valve chambers are provided outside of reservoir.	Elevated storage reservoirs or overhead tanks are provided in those areas which are not governed and controlled by the gravity system of the distribution.
5.	Surface reservoirs are constructed in water filtration plants and for storage at source from where water is pumped.	These are constructed where combine gravity and pumping system of water distribution is adopted.

HOW TO CALCULATE STORAGE CAPACITY OF RESERVOIRS:

Two steps are involved in calculation of storage capacity of reservoirs.

1. **Balancing storage:** The quantity of water required to be stored in the reservoir
   For equalizing or balancing fluctuating demand against constant supply is known as balancing storage or operating storage.
2. **Breakdown storage:** The breakdown storage or often called emergency storage is the storage preserved in order to tide over the emergencies by the failure of pumps, electricity or any other issue.
   Value of about 25% of the total storage capacity of reservoir or 1.5 to 2 times of the average hourly supply may be considered as enough provision for accounting this storage.

QUESTION NO. 4:

1. **Why pumps are used in water supply schemes?**
   Pumps are used for a constant flow (Q) of water at a constant pressure (P) in water supply system pump rifts water from source i.e tube well and transmit to storage tank or distribution system at specific velocity. It also lifts water from storage and other sources like rivers, lakes and dispatch it though transmission pipes to filtration plants at higher lever. Mostly centrifugal pumps are used in water supply system that is most efficient in working.

2. **How to calculate the pumps curve to meet demand?**
   Pumps curve calculation is done basically to study and analyze the given head (H) to which water is to supplied. It is combination of static head and friction losses in pipes which also called Dynamic head. At a given flow rate (Q) and Dynamic head the curve is calculated and required horsepower pump is selected based on various efficiencies. In curve flow rate is plotted on x-axis while head (friction head) on y-axis and required value is taken from curve.