UNIT -5

WATER MANAGEMENT IN IRRIGATION

PART -A

1) What are the causes of water loss? **(AU MJ 2008,MJ 2011)**

- Seepage From The Canal
- Over Irrigation Of Field
- Heavy Surface Runoff

2) What are ways of water loss in the canal? **(AU MJ 2008,MJ 2012)**

- Seepage Loss
- Evaporation Loss

3) What are factors on which seepage loss depends? **(AU ND 2008,ND 2010)**

- Position Of Water Table
- Porosity Of Sub-Soil
- Porosity Of Soil
- Extend Of Absorbing Medium

4) What are two different condition of seepage? **(AU ND 2008, ND2012)**

- Percolation
- Absorption

5. What are the remedial measures for losses? **(AU ND 2009,MJ 2012)**

- Efficient Surface Drainage
- Restriction Of Irrigation
- Change In Crop Pattern

6) What are the advantages of irrigation water managements? **(AU ND 2009,ND 2011)**

- Achievement of optimum irrigation efficiency
- Economical and efficient operation and maintenance of irrigation system
- Equitable distribution of supplies to irrigators especially at the end

7) Discuss some components of water management? **(AU MJ 2010,ND2012)**

- Water shed management
- Land management
- Rain water management
- Reservoir management

8. What are the impact of water user association? **(AU MJ 2010,MJ 2011)**

- Conveyance efficiency
- Operation efficiency
- Equity
- Area water unit ratio

9.) What are the advantages of water user association? **(AU MJ 2009,MJ 2011)**

- Better maintenance of the distributary
- Possibility of high value of crop programme
- Availability of water and irrigation process

10) What are optimization of water user association? **(AU MJ 2009,ND 2010)**

- To reduce the seepage loss and conveyance
- Control over the usage of water

PART-B

1 write notes on Productivity, Equity, Conjunctive use of water, Short – term stability, Long – term stability. (AU MJ 2008)

Productivity

Productivity is defined as the ratio of output and input. The output can bewater delivered, area irrigated, yield, or income, and the input can be water in the rootzone, at the farm gate at the outlet or at upstream points in the system including thepoint of diversion or storage. Improved water supply influences the adoption of high –yielding agricultural practices by farmers which justify the productivity criterion ofperformance.

Equity

Equity in canal irrigation systems implies equality, fairness, and even-handeddealing in matters of allocation and appropriation of irrigation water. There can beseveral ways to decide the equality of supplies to different farmers. Two of them,practiced throughout the world, are the methods of prior appropriation and ofproportionate equality.

Conjunctive use of water

Conjunctive use means that water lifted from below the ground is used inconjunction with canal waters. It results in the coordinated, combined, and creativeexploitation of ground water and surface water so as to minimize the dislocationcaused by nature's inconsistent rainfall pattern. Such coordinated use of surface andground waters results in increased amount of available water, smaller surfacedistribution system, smaller drainage system, reduced canal linings, greater floodcontrol, and smaller evaporation losses.

Short – term stability

The short – term or interseasonal stability refers to the variations inproductivity and equity between irrigation seasons, and is a function of climate, watersupply, storage and control, system management, and other factors such as pests,diseases, and

availability of labour and other inputs. It can be measured by comparingperformance between seasons.

Long – term stability.
The long – term stability is defined as "environmental stability" and"durability" and refers to the prevention or minimizing of adverse physical changessuch as waterlogging, leaching of nutrients form soils, salinity, erosion, silting, the'mining' of ground water, and infestations with weeds.

2 what are the Main components of soil reclamation (AU ND 2008)

- The main components of soil reclamation works are as follows
- Isolation of land areas according to their categorization and levelling andbonding of the affected land as per the category.
- Provision of drainage (surface or subsurface or vertical) network to removeleaching water and to keep the water table to a safer level.
- Breaking up of impervious subsoil layer in alkali soils by deep ploughing.
- Adding suitable chemicals (such as gypsum, sulphur, etc.) depending upon theresults of chemical tests of the affected soil.
- Operation & maintenance of irrigation system is necessary
- A proper plan for operation and maintenance is, therefore, necessary toAchieve stipulated levels of project services including maintenance atminimum achievable cost.
- Achieve optimum use of canal water.
- Provide detailed operation and maintenance guidelines during variousanticipated scenarios of water availability, including equitable waterdistribution up to the tail-end of the system, and
- Effect efficient coordination of staff, equipment, physical and financialresources and related disciplines, active involvement of farmers.

3 i)What are the different Water losses be control: (AU MJ 2009)

The following are the measures that are generally taken to control the waterlosses from the reservoir.

1. Measure to Reduce Evaporation Loss

a) The reservoir should be constructed of less surface area and more depth.

b) Tall trees should be grown on the windward side of the reservoir whichact as wind breakers and hence the rate of evaporation will be reduced.

c) The reservoir basin should be surrounded by plantation or forest area sothat cooler environment exists within the reservoir area.

d) Certain chemical like cetyl alcohol is spread over the reservoir surface. Itforms a thin film on water surface reducing evaporation.

2. Measure to Reduce Absorption Loss

a) The weeds and plants at the periphery of the reservoir should be removedcompletely

b) The weeds from the surface of the reservoir should be removed.

3. Measure to Reduce Percolation Loss

a) Geological investigations should be carried out to locate the zones of perviousformations, cracks and fissures in the bed and periphery of the reservoir basin.

b) Suitable treatments should be adopted to stop the leakage of water throughthese zones.

c) Soil stabilization methods should be adopted if the basin is composed ofpermeable bed soil.

3ii) Explain Water logging (AU MJ 2009)

In agricultural land, when the soil pores within the root zone of the crops getsaturated with the subsoil water, the air circulation within the soil pores gets totallystopped. This phenomenon is termed as water logging. The water logging makes thesoil alkaline in character and the fertility of the land is totally destroyed and the yieldof crop is reduced.

Effects of water logging

The following are the effects of water logging:

- Stabilization of soil
- Lack of aeration
- Fall of soil temperature
- Growth of weeds and aquatic plants
- Diseases of crops
- Difficulty in cultivation
- Restriction of root growth

Methods used for controlling water logging

The following measures may be taken to control water logging:

- Prevention of percolation from canals
- Prevention of percolation from reservoirs
- Control of intensity of irrigation
- Economical use of water
- Fixing of crop pattern
- Providing drainage system
- Improvement of natural drainage

- Pumping of ground water
- Construction of sump well

4 What are the Inadequacies of present – day canal irrigation management in India. (AU ND 2009)

From the point of view of performance, the management of the canal

irrigation systems in India is far from satisfactory. The major inadequancies are as

follows.

- Insufficient planning and preparation at the stage of execution of the projectwhich results in longer construction time and escalated project cost,
- Involvement of more than one ministry/department and poor coordinationamong them,
- Non-responsive, authoritarian, and poor administration resulting in increasedmalpractices,
- Lack of interaction between engineering and agricultural experts,
- Lag betweencreation of potential and its utilization,
- Improper assessment of personnel, equipment, and other facilities for properoperation and maintenance of reservoirs and canal systems resulting in erratic(unreliable and insufficient) supplies inequitable distribution of availablewater,
- Higher conveyance losses,
- Absence of conjunctive use of ground water and surface water

Insufficient drainage, excessive seepage, and waterlogging,

- Poor on-farm management,
- Absence of farmer's participation in the management,
- Lack of communication facilities in the command area,
- Poor extension services– lack of pilot projects, demonstration farms, etc.,
- Problems related to land settlement and rehabilitation of displaced persons,

and

- Recovery of the project cost.

5 Explain Performance of an irrigation system. (AU MJ 2010)

There are several conventional measures to improve the performance of canalirrigation systems. Some of these measures are lining of canals and field channels, onfarmdevelopment, farmers organization, warabandi system of water distribution,charging farmers volumetrically for water, and education farmers in water usemanagement. Before seeking a solution to improve the irrigation management, it isworthwhile to consider the objectives of irrigation and the criteria for judging theperformance of an irrigation project.

The criteria for judging the performance of canal irrigation systems can bevastly different for different groups of people depending upon their concerns . However, the most common criteria generally accepted for judging theperformance of an irrigation system are productivity, equity, and stability whichtogether contribute to the objective of well-being.

Productivity

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6 Methods adopted for improving canal irrigation management Explain in detail. (AU ND 2010)

Irrigation management is an interdisciplinary system process with a built-inlearning mechanism to improve system performance by adjusting physical,technological, and

institutional inputs to achieve the desired levels of output. Canalirrigation is a complex process involving physical, bio-economic, and humanactivities which are interrelated and vary widely over space and time. As such, canalirrigation management demands special methods. Every management problemrequires be analyzing in detail and then solving accordingly. Nevertheless, there aresome aspects which, if considered properly at different stages, can help significantlyin the improvement of canal irrigation. These aspects have been briefly dealt with inthe following.

Cropping Pattern

Cropping pattern is described in terms of the area under various crops atdifferent periods of a year. An optimum cropping pattern for an area can ideally bedetermined by using systems analysis. If the local preferences and requirements of thearea are included in the analysis, and the necessary inputs are made available, thefarmers will adopt the cropping pattern arrived at using systems analysis.

Conjunctive Use

Conjunctive use means that water lifted from below the ground is used inconjunction with canal waters. It results in the coordinated, combined, and creativeexploitation of ground water and surface water so as to minimize the dislocationcaused by nature's inconsistent rainfall pattern. Such coordinated use of surface andground waters results in increased amount of available water, smaller surfacedistribution system, smaller drainage system, reduced canal linings, greater floodcontrol, and smaller evaporation losses. There are, however, some disadvantages tooin resorting to conjunctive use. These require lesser hydroelectric power, greaterpower requirement, need for artificial recharge, and danger of land subsidence. Theparameters related to conjunctive use, such as cropping pattern, canal capacities,capacities and spacing of wells, drainage requirements, optimum ground water level,etc. are the best determined by systems analysis to derive maximum benefits.

Channel Capacity

The discharge capacity of the channel system should be decided on theconcept of evapotranspiration rather than the 'kor' period.

Canal Lining

Lining of canals is a means to reduce the seepage losses from canals. In orderto prevent damage to lining, the slope of a lined channel is reduced. This reduces thesediment carrying capacity of an existing channel which is being lined. Therefore,measures for sediment exclusion are to be considered whenever an existing canal isbeing lined. Alternative to the lining of canals is the conjunctive use of surface andground unit cost of pumped water.

Regulators and escapes

For ensuring proper distribution of irrigation water according to the adoptedmanagement policy, a suitable number of canal regulators and canal escapes must beprovided on the channel network in general and on main canals and branches

inparticular. Canal escapes are needed for the safety as well as for regulating canalsupplies in areas which have received excess rainfall.

Canal Outlets

Another important aspect of designing canal irrigation system is the selectionof suitable type of outlet which is crucial in controlling the distribution of water andproviding a link between the administration and the farmer. From the considerationsof equitable distribution of water, a regulated outlet would be an ideal choice providedthat it can be operated efficiently and honestly.

Main System Management

Operational management of the main system refers to management aspects ofthe future allocation, scheduling, delivery of water on main systems down to andincluding outlets, and the disposal of water in drains below chaks (i.e. the irrigatedfields). It includes planning, decision making, the operation of controls, andcommunications both upwards to managers and downwards to groups of farmers sothat equitable supplies can be ensured throughout the command area. Main systemmanagement (MSM) is capable of reducing gross inequities of water supply to tailedfarmers and increasing the farm yield from the command area.

A more rational method for the running schedule of distributaries and minorscan, alternatively, be worked out as follows.

- Obtain the cropping pattern, preferably an optimum one, for irrigation during the ensuring season.
- Estimate weekly evapotranspiration and corresponding effective rainfall based on past records.
- Determine the irrigation demand.
- Decide upon the amount of canal water and groundwater to meet the irrigation demand such that the desired intensity of irrigation on the optimum cropping pattern can be obtained along with a stable water table, and
- Prepare a roster of regulation of distributaries and minors and notify the concerned farmers well in advance to enable them to plan their sowing and irrigation programmes accordingly.

Night Irrigation

In most of the canal irrigation projects, the canal water continues to flow at nights as well and is either badly used or wasted. Darkness, cold, fear, normal working hours and desire for sleep discourage the irrigation staff, farmers, and

labourers to work at night. Farmers usually dislike night irrigation for the following reasons.

- Loss of sleep and disruption in the normal sleeping duration,
- Discomfort due to cold night and difficulty in moving around in sticky soilsand mud,
- Danger and fear of snakes, scorpions, accidents, violence including murder,and other problems related to law and order,
- Inefficient application of water due to darkness, and
- Higher costs due to higher night wages, non-availability of family labour,especially women, old people and those very young to work at night, and needof firewood, beverages and lighting.High and dense crops and crops in the later stages of growth are relativelydifficult to be irrigated at night. Sometime night irrigation is preferred by farmers dueto the following reasons. Sometimes night irrigation is preferred by farmers due to thefollowing reasons
- In warmer regions, farmers find it more comfortable to irrigate at night.
- Part-time farmers having other work during the day would prefer nightirrigation.
- Tail-end farmers may get relatively more adequate and reliable supply duringnight.

7 Evaluation of performance of canal irrigation systems. (AU ND 2011)

To manage a system properly, the physical effectiveness of past operationsmust be considered against the original criteria set forth for the project, or assubsequently amended following modification of the facilities. Procedures for actingon the indicators uncovered in evaluation are critical to the financial and operationalefficiencies of a system. Priorities for adjustments in the system and scheduling theneeded maintenance can best be made by using inputs for timely and properevaluation reports. Some of the diagnostic analyses that can be considered are:

Farmers operations performance

- Adequacy of crop production techniques for irrigated farming including

adequacy of supply of inputs such credit, certified seeds, fertilizers,

pesticides, etc.,

- Adequacy of irrigation methods
- Farm management and economic results
- Soil management and erosion control, and
- On-farm efficiency of water use.
- Delivery operational performance
- Water use efficiency in distribution

- Water losses(physical including evaporation)
- Project overall water use efficiency
- Deep percolation
- Canal seepage
- Spillage from canals
- Dam and foundation seepage
- Water operational losses (such as leakage from gates, etc.)
- Adequacy of delivery scheduling,and
- Energy use
- Drainage operational performance
- Drainage requirement area-wise
- Water table fluctuations by season and years
- Water quality changes reach-wise for drain effluents, and
- Soil salinity changes area-wise

8 What are the Merits and demerits of canal lining (AU MJ 2011)

The following are the main objects of canal lining:

To Control Seepage

The seepage loss is the maximum loss in unlined canals. Due to seepage theduty of canal water is much reduced which involves enhancement of storage capacityof a reservoir by constructing high dam. Thus, the expenditure of the project isincreased. So, to control the seepage loss through the bed and sides of the canal, thelining of the canal is necessary.

To Prevent Water-Logging

Along the course of the canal, there may be low lying areas on one side orboth sides of the canal. Due to the seepage of water through the sides of the canal,these areas may get converted into marshly lands. This water-logging makes the landalkaline which is unsuitable for agriculture. This water-logged area may become thebreeding place of mosquitoes which are responsible for many infectious diseases.

To Increase the Capacity of Canal

In unlined canal, the velocity of flow should be fixed such that the silting andscouring is avoided. In practice, the velocity should always be kept below 1 m/sec.Due to the low velocity; the discharge capacity of the canal becomes low. In unlinedcanal, if the capacity of the canal is to be increased the cross-sectional area has to beincreased which involves more land width. So, the lining of the canal should be suchthat the velocity and the discharge of the canal are more with minimum crosssectionalarea.

To Increase the Command Area

If the lining is provided in the canals the various losses can be controlled andultimately the command area of the project may be enhanced.

To Protect the Canal from the Damage by Flood

The unlined canals may be severely damaged by scouring and erosion causeddue to the high velocity of flood water at the time of heavy rainfall. So, to protect thecanals from the damage, the lining should be provided.

To Control the Growth of Weeds

The growth of various types of weeds along with the sides of the canals is acommon problem. Again, some types of weeds are found to grow along the bed of thecanals. These weeds reduce the velocity of flow and the capacity of the canals. So, theunlined canals require excessive maintenance works for clearing the weeds. If liningis provided in the canal may be increased.

The advantages and disadvantages of the canal lining were discussed below.

- Advantages of Canal Lining
- It reduces the loss of water due to seepage and hence the duty is enhanced.
- It controls the water logging and hence the bad effects of water-logging are eliminated.
- It provides smooth surface and hence the velocity of flow can be determined.
- Due to the increased velocity, the evaporation loss also be reduced
- It eliminates the effect of scouring in the canal bed.
- The increased velocity eliminates the possibility of silting inthe canal bed.
- It controls the growth of the weeds along the canal sides and bed.
- It provides the stable section of the canal.
- It reduces the requirement of land width for the canal, because smaller section of the canal can produce greater discharge.
- It prevents the sub-soil salt to come in contact with the canal water.
- It reduces the maintenance cost for the canals.
- Disadvantages of Canal Lining
- The initial cost of the canal lining is very high. So, it makes the project very expensive with respect to the output.
- It involves much difficulty for repairing the damaged section of lining.

- It takes too much time to complete the project work.
- It becomes difficult, if the outlets are required to be shifted or new outlets

are required to be provided, because the dismantling of the lined section isdifficult.

9 what are Different types of canal lining (AU ND 2011)

The following are the different types of lining which are generallyrecommended according to the various site conditions.

- Cement concrete lining
- Pre-cast concrete lining
- Cement mortar lining
- Lime concrete lining
- Brick lining
- Boulder lining
- Shot crete lining
- Asphalt lining
- Bentonite and clay lining
- Soil-cement lining

Cement Concrete lining

This lining recommended for the canal in full banking. The cement concretelining (cast in-situ) is widely accepted as the best impervious lining. It can resist theeffect of scouting and erosion very efficiently. The velocity of flow may be keptabove 2.5 m/sec. It can eliminate completely growth of weeds. The lining is done bythe following steps.

a) Preparation of sub-grade

The sub-grade is prepared by ramming the surface properly with a

layer of sand (about 15 cm). Then, the slurry of cement and sand (1:3) is

spread uniformly over the prepared bed.

b) Laying of concrete

The cement concrete of grade M15 is spread uniformly according to the

desired thickness (generally, the thickness varies from 100 mm to 150 mm).

After laying, the concrete is tapped gently until the slurry comes on the top.

The curing is done for two weeks. As the concrete is liable to get damaged by

the change of temperature, the expansion joints are provided at appropriate

places. Normally no re-inforcement is required for this cement concrete. But

in special cases, a network of 6 mm diameter rods may be provided with spacing 10 cm centre to centre.

Pre – Cast Concrete Lining

This lining is recommended for the canal in full banking. It consists of precastconcrete slabs of size 60 cm x 60 cm x 5 cm which are set along the canal bankand bed with cement mortar (1:6). A network of 6 mm diameter rod is provided in theslab with spacing 10 cm centre of centre. The proportion of the concrete isrecommended as 1:2:4. Rebates are provided on all the four sides of the slab so thatproper joints may be obtained when they are placed side by side. The joints arefinished with cement mortar (1:3). Expansion joints are provided at a suitable interval.

The slabs are set in the following sequence,

a) The sub-grade is prepared by properly ramming the soil with a layer of sand. The bed is leveled so that the slabs can be placed easily.

b) The slabs are stacked as per estimate along the course of the canal. The slabs are placed with cement mortar (1:6) by setting the rebates properly. The joints are finished with cement mortar (1:3).

Cement Mortar Lining

This type of lining is recommended for the canal fully in cutting where hard soil or clayey soil is available. The thickness of the cement mortar (1:4) is generally 2.5 cm. The sub-grade is prepared by ramming the soil after cutting. Then, over the compacted sub-grade, the cement mortar is laid uniformly and the surface is finished with neat cement polish. This lining is impervious, but is not durable. The curing should be done properly.

- Lime Concrete Lining

When hydraulic lime, surki and brick ballast are available in plenty along the course of the canal or in the vicinity of the irrigation project, then the lining of the canal may be made by the lime concrete of proportion 1:1:6. The procedure of laying this concrete is same as that of the cement concrete lining. Here, the thickness of concrete varies form 150 mm to 225 mm and the curing should be done for longer period. This lining is less durable than the cement concrete lining. However, it is

recommended because of the availability of the materials and also because of the economics.

- Brick Lining

This lining is prepared by the double layer brick flat soling laid with cement mortar (1:6) over the compacted sub-grade. The first class bricks should be recommended for the work. The surface of the lining is finished with cement plasters (1:3). The curing should be done perfectly.

This lining is always preferred for the following reasons,

a) This lining is economical

b) Work can be done very quickly

c) Expansion joints are not required

d) Repair works can be done easily

e) Bricks can be manufactured

Boulder Lining

In hilly areas where the boulders are available in plenty, this type of lining isgenerally recommended. The boulders are laid in single or double layer maintainingthe slope of the banks and the bed level of the canal. The joints of the boulders aregrouted with cement mortar (1:6). The surface is finished with cement mortar (1:3).Curing is necessary in this lining too. This lining is very durable and impervious. Butthe transporting cost of the material is very high. So, it cannot be recommended for allthe cases.

Shot Crete Lining

In this system, the cement mortar (1:4) is directly applied on the sub-grade byan equipment known as cement gun. The mortar is termed as shot crete and the liningis known as shot crete lining. The process is also known as guniting, as a gun is usedfor laying the mortar. Sometimes, this lining is known as gunited lining. The lining isdone in two ways,

a) By Dry Mix

In this method, a mixture of cement and moist sand is prepared and loaded in the cement gun. Then it is forced through the nozzle of the gun with the help of compressed air. The mortar spreads over the sub-grade3 to a thickness which varies from 2.5 cm to 5 cm.

b) By Wet Mix

In this process, the mixture of cement, sand and water is prepared

according to the approved consistency. The mixture is loaded in the gun andforced on the sub-grade.This type of lining is very costly and it is not durable. It is suitable forresurfacing the old cement concrete lining.

Asphalt Lining

This lining is prepared by spraying asphalt (i.e. bitumen) at a very hightemperature (about 150oC) on the subgrade to a thickness varies from 3 mm to 6 mm.The hot asphalt when becomes cold forms a water proof membrane over the subgradeThis membrane is covered with a layer of earth and gravel. The lining is very cheapand can control the seepage of water very effectively but it cannot control the growthof weeds.

Bentonite and Clay Lining

In this lining a mixture of Bentonite and clay are mixed thoroughly to form asticky mass. This mass is spread over the sub-grade to form an impervious membranewhich is effective in controlling the seepage of water, but it cannot control the growthof weeds. This lining is generally recommended for small channels.

Soil – Cement Lining

This lining is prepared with a mixture of soil and cement. The usual quantityof cement is 10 percent of the weight of dry soil. The soil and cement are thoroughlymixed to get a uniform texture. The mixture is laid on the sub-grade and it is madethoroughly compact. The lining is efficient to control the seepage of water, but itcannot control the growth of weeds. So, this is recommended for small channels only.

10 How can water be lost from a reservoir How can the losses be controlled? (AU MJ 2012)

The water losses from the reservoir may be of the following types:

Evaporation Loss

The water is lost by evaporation due to the heat energy of the sun. This lossincreases with the increase of temperature and velocity of wind. The evaporation lossis directly proportional to the exposed water surface of the reservoir. The more thesurface area, the more is the evaporation loss.

Absorption Loss

There are some types of plants which grow by the side and some plants orweeds grow on the surface and bottom of the reservoir. These plants absorb waterfrom the reservoir. This is water loss by absorption.

Percolation Loss

Complete water tight or impervious basin is not feasible. The basin willconsist of pervious loose soil or rock, cracks, fissures, etc through which aconsiderable amount of water percolates. The percolation loss is a major problem inreservoir basin.

The following are the measures that are generally taken to control the water

losses form the reservoir.

Measure to Reduce Evaporation Loss

e) The reservoir should be constructed of less surface area and more depth

f) Tall trees should be grown on the windward side of the reservoir whichact as wind breakers and hence the rate of evaporation will be reduced.

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Measure to Reduce Percolation Loss

a) Geological investigations should be carried out to locate the zones ofpervious formations, cracks and fissures in the bed and periphery of thereservoir basin.

b) Suitable treatments should be adopted to stop the leakage of water throughthese zones.

c) Soil stabilization methods should be adopted if the basin is composed ofpermeable bed soil.

The following are the objects of water management:

a) Supply of water

The irrigation water should be supplied to the cultivators at the righttime for the maximum yield of crop.

b) Equitable distribution

The irrigation water should be equally shared by the cultivators.

c) Irrigation efficiencies

Optimum irrigation efficiencies should be achieved to enhanceagricultural product.

d) Maintenance of Irrigation system

The maintenance of the irrigation system should be done properly tomake the project economical.

11 what are different Kinds of participation are necessary for irrigation management activities (AU ND 2012)

The interaction of physical and organizational aspects of irrigation makes it asocio-economic process, exemplified by the three focuses of irrigation activity whichare closely linked with one another:

 Some activities focus on the water which is to be provided in an adequateand timely manner to crops;

 Other activities focus on the structures which give control over the waterfor its application to crops; and

 Still other activities maintain the organization of effort which can managethe structures that control the water.

The first set of activities focuses on water use:

 ACQUISITION of water from surface or sub-surface sources, either bycreating and operating physical structures like dams, weirs or well, or byactions to obtain for users some share of an existing supply.

 ALLOCATION of water by assigning rights to users, thereby determiningwho shall have access to water.

 DISTRIBUTION of water brought from the source among users at certainplaces, in certain amounts, and at certain times.

 DRAINAGE of water, where this is necessary to remove any excesssupply.Other activities deal with structures for water control. These are already astandardized classification for delineating such activities with regard to physicalstructures.

 DESIGN of structures such as dams or wells to acquire water, channelsand gates to distribute it, and drains to remove it.

 CONSTRUCTION of such structures to be able to acquire, distribute andremove water.

 OPERATION of these structures to acquire, distribute and remove wateraccording to some determined plan of allocation

MAINTENANCE of these structures in order to have continued andefficient acquisition, distribution and removal of water.Each of these activities relates to and facilities the preceding water useactivities. They are as relevant to organizational structures as to physical ones. Whilethe structures required for acquisition, distribution and drainage of water are basicallyphysical, those for its allocation are essentially legal or contractual. A capacity forallocation needs to be planned, established, operated and maintained just as surely asdoes the capacity of a reservoir or a drainage system. Even if allocation activities arenot as material as those for acquisition, distribution and drainage, the parallels interms of the activities involved are substantial

COMMUNICATIONThis concerns the needs and problems in any of the activity areas notedabove, conveying information about decisions made, about resource mobilization,bout conflicts to be resolved, etc. to farmers or any other persons involved inirrigation. One purpose of communication may be COORDINATION.

CONFLICT MANAGEMENT

This must deal with differences of interest that arise form activities ofacquisition, allocation, distribution, drainage, design, construction, operation ormaintenance, or from organizational activities generally.Organizational management activities refer both to physical objects like

wateror gates and to social relations among people. Resource mobilization deals mostlywith materials resources but also with non-material things like information and ideas.Even acquiring water through dam or pumping facilities is thoroughly socio-technicalbecause decision-making, resource mobilization, communication, and conflictmanagement are intimately associated with the physical structures and resource flows.