

GUJARAT TECHNOLOGICAL UNIVERSITY

7th Semester Civil Engineering - PDDC

Subject Code & Name: X70605 - Irrigation Water Management (Department Elective-I)

Sr. No.	Course content
1.	<p>Indian water resources scenario and water management issues related to irrigated agriculture, Introduction to use of remote sensing and GIS technologies in study of irrigated areas.</p> <p>Land grading and field layout-Criteria for land levelling- Layout of fields and irrigation and drainage systems. Design aspects in border strip method, check basin method and furrow irrigation.</p>
2.	<p>Sprinkler irrigation:- Types of sprinkler irrigation systems-rotating head system and perforated system-Components of sprinkler system-Moisture distribution patterns and uniformity of coverage, Hydraulic design of sprinkler system- design problem, Operation and Maintenance of sprinkler systems.</p> <p>Drip irrigation method:- components of drip irrigation system-principles of design of drip irrigation-design problem. Problems associated with drip irrigation systems, Application of fertilizers and chemicals through pressurized irrigation systems (both sprinkler and drip).</p>
3.	<p>Irrigation efficiencies:- project irrigation efficiency, Scheduling of irrigation-time of irrigation –critical stages of water needs of crops-criteria of scheduling irrigation- frequency and interval of irrigation depth. Irrigation water quality-surface water and groundwater quality of irrigation water- irrigation with saline water-improving quality of water –leaching requirements.</p>
4.	<p>Water management in high water table areas:- causes of water logging, Classification of drainages, Prevention of high water table, Canal irrigation management-operation and management of canal irrigation, performance evaluation of a canal irrigation system. Community participation in irrigation water management, water users organization, merits and demerits of water users organization, Case Studies</p>

Note: Each module carries equal weightage

Term work: Tutorial problems based on above mentioned syllabus

Text Books:

1. D.K. Majumdar, Irrigation Water Management Principles and Practice, PHI
2. A.M. Michael, Irrigation –Theory and Practice, Vikas Publication, New Delhi
3. G.L. Asawa, Irrigation Engineering, Wiley Eastern Ltd.

Reference Books/Report:

1. O.W. Israelsen and V.E. Hansen, Irrigation Principles and Practice, John-Wiley and Sons, New York
2. S. Thiruvengadachari, R. Sakthivadivel, Satellite remote sensing for assessment of irrigation system performance: a case study in India By, Research Report, International Irrigation Management Institute Colombo, Sri Lanka
3. B.D. Dhanwan Studies in Irrigation and Water Management, Common Wealth Publishers, New Delhi

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII EXAMINATION – SUMMER 2016

Subject Code: X70605**Date: 05/05/2016****Subject Name: Irrigation Water Management****Time: 02:30 PM to 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Discuss the commonly used irrigation indices in scheduling irrigation. **07**
 (b) What are the effects of saline water on irrigated land? Which precautions should be taken during use of saline water? **07**

- Q.2** (a) Describe the maintenance of sprinkler nozzles. Give expression for nozzles discharge and process of calculating nozzle diameter. **07**
 (b) An irrigation system of 0.15 cumecs is irrigating a ring basin of radius 7m. The water holding capacity of soil is 23% per meter depth. Prior to water application, the moisture content of the soil is found 8.2%. The depth of root zone is 1.5m. The apparent specific gravity of the root zone soil is 1.9. How long irrigation stream would be applied to the basin to replenish the root zone moisture to its field capacity. **07**

OR

- (b) Plan a suitable drip irrigation system for an orchard on nearly flat land with medium heavy soil. The dimensions of the fields are 420×180m. The source of water is a tube well located at the top corner of farm. The tree spacing is 5×5 m. Emitters are spaced 1m apart in each lateral. The monthly evaporation rate observed with a class A pan is 250mm. Irrigation is to be applied daily. Determine the discharge capacity of the drip irrigation system. Take, maximum diameter of wetted circle form by a dripper = 2.5m, crop coefficient for orchard=0.8, pan factor=0.8, water application efficiency is 87%. **07**
- Q.3** (a) Discuss how various irrigation efficiency indicators can be used for performance evaluation of canal irrigation system. **07**
 (b) (I) Explain WUO. **07**
 (II) Give the advantage of subsurface drainage in comparison to surface drainage.

OR

- Q.3** (a) Explain moisture distribution patterns and uniformity of coverage for sprinkler irrigation. **07**
 (b) Draw Schematic layout of typical drip irrigation system. Enlist component of it. **07**

- Q.4** (a) What are the factors affecting land leveling requirement? Distinguish between land leveling and land smoothening. **07**
 (b) Give difference between border strip irrigation and check basin irrigation. **07**

OR

- Q.4** (a) Explain how remote sensing and GIS can be used for monitoring of irrigated areas. Explain soil moisture studies by use of remote sensing in this context. **07**
 (b) What is accumulated infiltration in furrow? What is the principle of cutback stream in furrow irrigation? **07**

- Q.5** (a) What are the limitations in the large scale adoption of sprinkler irrigation in many of the developing countries? **07**
- (b) Define Frequency of irrigation. Explain factors affecting of it. **07**
- OR**
- Q.5** (a) Define application, storage and water use efficiency and explain how application efficiency can be improved. **07**
- (b) Define leaching. Write short note on 'Reclamation of saline soils by leaching method'. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII EXAMINATION – WINTER 2015

Subject Code: X70605**Date: 04/12/2015****Subject Name: Irrigation Water Management,****Time: 10:30pm to 1:00pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain the design concepts and design criteria for sprinkler irrigation for diameter of laterals and mains, height of risers and nozzle diameter. **07**
- (b) Discuss the parameters which make drip irrigation a better choice than sprinkler irrigation. **07**

- Q.2** (a) (i) Enlist the crops which are tolerant to high water tables. (ii) Name the plants and trees which act as 'natural pumps' and should be grown in high water table areas to lower the water table. (iii) Explain the advantages and disadvantages of surface drainage system provided in agricultural field. **07**
- (b) Draw sketches and illustrate the various sub surface drainage systems and explain their suitability. **07**

OR

- (b) (i) Draw the curve to illustrate optimum moisture content for healthy growth of plants, over irrigation and under irrigation. (ii) Why is over irrigation harmful? (iii) Why saline soils are not conducive to plant growth. **07**
- Q.3** (a) Mention the various stages of crop growth. Explain critical stage requirement. Work out a relationship between dry density, optimum moisture content, and field capacity to give depth of water to be applied to the crop. **07**
- (b) Describe a field method and write the statistical expression to find the uniformity coefficient of distribution of irrigation water for sprinkler system **07**

OR

- Q.3** (a) Enlist and explain the parameters to evaluate the performance of canal irrigation system **07**
- (b) Explain leaching requirements and illustrate how it affects the application efficiency. Compare the quality and suitability of ground water and surface water used for irrigation. **07**

- Q.4** (a) How will you identify canals, reservoirs and agricultural fields by visual interpretation of remotely sensed images. Explain the concepts involved in distinguishing between an irrigated and unirrigated area by processing a remotely sensed image in a GIS software. **07**
- (b) Discuss the advantages and suitability of furrow irrigation. How will you decide: furrow spacing, furrow length and slope. For a given soil is the same slope applicable for border irrigation? **07**

OR

- Q.4** (a) Discuss the Indian water resources scenario with respect to spatial and temporal variation of rainfall, overall water availability in major basins, ultimate irrigation potential and the potential created in the country. **07**
- (b) Explain the merits and demerits of water cooperative societies and highlight how community participation helps in more efficient use of irrigation water. **07**

- Q.5 (a)** Explain the factors affecting land slope in agricultural fields. Give the approximate value of land slope for heavy, medium and light soils. **07**
- (b)** A tube well is having a capacity of 4000 liters per hour and operates 20 hours each day during the irrigation season. How much area can it command if the irrigation interval is 20 days and depth of irrigation is 7 cm. **07**

OR

- Q.5 (a)** Explain briefly the following methods to calculate earthwork volumes during agricultural operations (i) Prismoidal method (ii) Four point method. Why is the four point formula preferred. **07**
- (b)** An area of 1 hectare was irrigated in 10 hours with a stream of 30 liters/second. Depth of root zone was 1 meter and available moisture holding capacity is 16cm/meter. Irrigation was given when 50% of moisture was depleted. Water application efficiency was 60%. Determine the water storage efficiency. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII • EXAMINATION – SUMMER • 2015

Subject Code: X70605**Date: 14/05/2015****Subject Name: Irrigation water management****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Enlist types of surface irrigation methods. Explain any one in detail. **07**
(b) Describe the various water management issues related to the field of irrigation. **07**
- Q.2** (a) Compare the sprinkler as well as drip irrigation in detail. **07**
(b) Explain with sketch the various components of sprinkler irrigation. **07**
- OR**
- (b) Explain with sketch the various components of drip irrigation. **07**
- Q.3** (a) Explain the applications of RS and GIS in the field of irrigation. **07**
(b) Write short note on application of fertilizers and chemicals through pressurized irrigation systems. **07**
- OR**
- Q.3** (a) Explain factors affecting land leveling for agricultural purpose. **07**
(b) Explain necessity of drainage and give the comparison of surface and sub surface drainage. **07**
- Q.4** (a) What is irrigation efficiency? Explain any two in detail. **07**
(b) Describe the operation and maintenance of drip irrigation system. **07**
- OR**
- Q.4** (a) Write short note on irrigation scheduling. **07**
(b) Define application, storage and water use efficiency and explain how application efficiency can be improved. **07**
- Q.5** (a) Describe in detail the operation and maintenance of canal irrigation system. **07**
(b) Describe the operation and maintenance of sprinkler irrigation system. **07**
- OR**
- Q.5** (a) Explain ill-effects and preventive measures of water logging. **07**
(b) Give the difference between furrow methods, border strip method and check basin method. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-VII • EXAMINATION – WINTER • 2014****Subject Code: X 70605****Date: 05-12-2014****Subject Name: Irrigation Water management****Time: 10:30 am - 01:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Name the components of sprinkler irrigation system. Discuss the components of the system in detail. **07**
- (b) What are the factors influencing the design capacity of a drip irrigation system? **07**
- Q.2** (a) Explain the importance of Community participation in irrigation water management. **07**
- (b) Calculate the capacity of a sprinkler system to apply water at a rate of 1.25 cm/hr. Two sprinkler lines 175 m long each with 15 sprinklers are spaced at 11.5 m interval on each line. The sprinkler lines are spaced at 18 m interval. **07**
- OR**
- (b) A stream flowing of 150 l/s was diverted from a canal and 115 l/s was delivered to the field. Find the conveyance efficiency of the canal. The depth of water penetration in the field varied linearly from 1.8 m at the head end to 1.1 meter at the tail end. Find the distribution efficiency at the field. **07**
- Q.3** (a) Explain the factors that influences land leveling requirement? **07**
- (b) Give difference between Border strip Irrigation and Check basin Irrigation. **07**
- OR**
- Q.3** (a) Explain surface irrigation and sub surface irrigation. **07**
- (b) Explain how RS & GIS can be used in the field of irrigation engineering. **07**
- Q.4** (a) Write a note on “Reclamation of saline soils by leaching method”. **07**
- (b) Write short note on irrigation scheduling. **07**
- OR**
- Q.4** (a) Explain the following: **07**
- i) Water conveyance efficiency iii) Water storage efficiency
- ii) Water application efficiency iv) Water distribution efficiency
- (b) What problems are associated with usage of poor quality irrigation water? **07**
- Q.5** (a) Describe in detail the operation & maintenance of canal irrigation system. **07**
- (b) Write a note on measures for prevention of water logging. **07**
- OR**
- Q.5** (a) Discuss in detail Classification of Drainage. **07**
- (b) Explain in detail the parameters of evaluating the performance of canal irrigation system. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII • EXAMINATION – SUMMER • 2014

Subject Code: X 70605**Date: 05-06-2014****Subject Name: Irrigation Water management****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Give a comparison of sprinkler and drip irrigation under the following heads: i). initial cost ii). Operation cost iii). Uniformity of Irrigation **07**
- (b) Find the variation of flow for the first and the last emitter of a drip system for a variation of 40% and 20% respectively of emitter head for the first and the last emitter. **07**
- Q.2** (a) Discuss in detail how the on farm application efficiency of irrigation water can be increased. **07**
- (b) Discuss how remote sensing and GIS can be used in monitoring and managing of command area of a canal. **07**
- OR**
- (b) State and explain the parameters used for evaluation of a canal irrigation scheme. **07**
- Q.3** (a) State and explain the objectives of water use cooperatives and their benefits to the farmers. **07**
- (b) Explain the factors affecting land leveling for agricultural purpose **07**
- OR**
- Q.3** (a) Explain for border irrigation, time of advancement and time of recession. Develop an expression for time of water front advancement “t” to cover a distance “x”. **07**
- (b) Classify the water resources of India in form of surface water and ground water, river and lake water, fresh water and salty water frozen water and water in other forms. **07**
- Q.4** (a) Explain irrigation with saline irrigation water and acceptable standards of irrigation water. **07**
- (b) An area of 1 hectare was irrigated in 10 hours with streams of 30 litres/second. Depth of root zone was 1 meter and available moisture holding capacity was 16cm/m. Irrigation was given when 50% of the available moisture was depleted. Water application efficiency was 60%. Find the storage efficiency. **07**
- OR**
- Q.4** (a) Enlist the preventive and curative measures to avoid water logging. Explain the preventive measures. **07**
- (b) (i) Give the suitability of furrow irrigation and the explain advancement and the ponding time for the check basin method. **07**
- (ii) Give the furrow spacing for potatoes and onion crop
- Q.5** (a) Give the difference between surface and sub surface drainage and comparative advantage and disadvantage. **07**
- (b) Explain different type of sprinkler irrigation systems and when the use of each type becomes necessary. **07**
- OR**
- Q.5** (a) Explain how uniformity coefficient for sprinkler irrigation is determined to monitor the distribution efficiency **07**
- (b) Explain the canal operations and methodology related to “Fixation of Turns” method of irrigation of fields in the command area. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: X70605**Date: 10-12-2013****Subject Name: Irrigation Water management****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) i. Give the equations for calculating friction head loss in blind pipes without nozzles **07**
ii Give the use of “F” correction factor for calculating head loss for a sprinkler lateral.
- (b) i. If the difference of head permitted between the first sprinkler and the last sprinkler is 20% of the head at the first sprinkler; find the difference of discharge between the first and the last sprinkler. **07**
ii. Write the expression for distribution efficiency in the agricultural field and explain its significance. Explain which method of irrigation gives better distribution efficiency.
- Q.2** (a) State the end area method and prismoidal method for earthwork calculations in land leveling operations in agricultural fields. Taking the grid spacing in an agricultural land leveling operation as 25 meters and the cut depths at the four vertex points of the square grid as 0.132, 0.186, 0.76 and 0.035m find the cut volume using the four point method **07**
- (b) Explain how remote sensing and GIS can be used for monitoring of irrigated areas. Explain soil moisture studies by use of remote sensing in this context **07**
- OR**
- (b) Explain factors affecting land leveling and explain how cut fill ratios are maintained in an agricultural field **07**
- Q.3** (a) Explain necessity of drainage and give the comparison of surface and sub surface drainage. **07**
- (b) Draw sketches to show the layout for border strip irrigation. Explain the suitability of border strip irrigation and discuss how the length, width and the slope decided for border strip irrigation. **07**
- OR**
- Q.3** (a) Give the design steps for components of drip irrigation system **07**
- (b) Give the preventive and curative measures to avoid water logging. **07**
- Q.4** (a) Draw sketches to show the layout of fields irrigated by furrow irrigation method. Explain how the shape size and the slope of furrows decided **07**
- (b) Find the time required for the water front to advance to a length of 205 meters for border strip 10 meters wide if the stream discharge is 0.045 cumecs, average depth of flow expected is 65 mm and average infiltration capacity is 50 mm/hr. Also find the maximum length that can be irrigated. **07**
- OR**
- Q.4** (a) Define application, storage and water use efficiency and explain how application efficiency can be improved **07**
- (b) Determine the discharge of an individual sprinkler for lateral spacing 20 m, nozzle spacing 15 m and infiltration capacity as 1.3 cm/hr. Calculate **07**

diameter of the same nozzle if coefficient of discharge is 0.95 and head at sprinkler is 30 meters

- Q.5** (a) Explain the plane method and profile method of land levelling **07**
(b) Furrows 120 m long 0.9 m apart have a slope of 0.35% and are irrigated by a n **07**
initial non erosive stream for one hour. The stream size is then reduced to one third and continued for 45 minutes. Determine the average depth of irrigation

OR

- Q.5** (a) Explain the concept of water cooperatives and their benefits to farmers for **07**
better utilization of irrigation waters.
(b) i Explain evaporation losses in wild flooding and furrow irrigation **07**
ii Explain the suitability of sprinkler and drip irrigation with respect to
crop,
soil, topography and climate.

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: X 70605**Date: 01/01/2013****Subject Name: Irrigation Water Management****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Give the breakup of total head into four different components against which the pump in a sprinkler irrigation system has to work and explain each. **07**
(b) Differentiate between water application efficiency and water storage efficiency and give the significance of each. **07**
- Q.2** (a) Give the role of remote sensing in monitoring of irrigated areas. **07**
(b) A stream flowing at the rate of 140 l/s was diverted from a canal and 100 l/s was delivered to the field. Find the conveyance efficiency of the canal. The depth of water penetration in the field varied linearly from 1.8 m at the head end to 1.1 meter at the tail end. Find the distribution efficiency at the field. **07**
- OR**
- (b) Determine the system capacity for a sprinkler system for maize crop for an area of 15 hectares. Take design moisture use rate of 5mm/day, moisture replaced in soil at each irrigation 6cm., irrigation efficiency 75%, irrigation period 8 days. The irrigation interval is 12 days and the system is operated for 20 hours a day. **07**
- Q.3** (a) Give a comparison of sprinkler and drip irrigation. **07**
(b) Explain how land grading for agricultural purposes is done taking into consideration the following factors: type of soil, rainfall characteristics and irrigation methods. **07**
- OR**
- Q.3** (a)(i) Describe the maintenance of sprinkler nozzles. (ii) Give the expression for nozzle discharge and the process of calculating nozzle diameter. **07**
(b) Explain the criteria for fixing furrow size, furrow slope and the stream size in furrow irrigation. **07**
- Q.4** (a) How is friction head loss calculated in drip lateral and explain the nature of energy line in the drip lateral **07**
(b) Explain irrigation interval and irrigation period. Explain how irrigation interval is fixed for a particular crop **07**
- OR**
- Q.4** (a) (i) Define project efficiency. **07**
(ii) Give the advantage of subsurface drainage in comparison to surface drainage. **07**
(b) Enlist the repair and maintenance works to be carried out for canals **07**
- Q.5** (a) Explain the effect of salts on the quality of irrigation water and how presence of excessive dissolved salts is harmful for healthy crop growth. **07**
(b) Give the suitability of border irrigation with respect to crops and soils. How the length, slope of the border are fixed and how is the stream size decided. **07**
- OR**
- Q.5** (a) Discuss how various irrigation efficiency indicators can be used for performance evaluation of canal irrigation system **07**
(b) Discuss the ill effects of water logging. **07**
