

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**Course Curriculum****WATER RESOURCES MANAGEMENT
(Course Code: 3340604)**

| Diploma Programme in which this course is offered | Semester in which offered |
|--|----------------------------------|
| Civil engineering | 4 th Semester |

1. RATIONALE:

Knowing extremity of water crisis, we must appreciate water as 'God's greatest Gift'. Our water requirement is rapidly increasing due to vast industrial development and population growth. We are mostly dependent on rains as a predominant source of water.

The other important source of water is the ground water which is dependent on rainfall. We know that ground water table is declining very fast due to its increased use and also due to insufficient rainfall every year, the ground water table is gradually lowering down.

To stress upon the concept of water management and simultaneously to create the awareness about the proper use and conservation of water, this course is specially designed for the students of Diploma in Civil Engineering.

An attempt has been made to develop theoretical knowledge with significance of water resources aspects. The finalization of topics viz. Hydrology, runoff, watershed management, recharging etc. have been specifically emphasized in the curriculum as per present needs.

2. COMPETENCIES (Programme Outcomes according to NBA Terminology):

The course content should be taught with the aim to develop the students theoretical knowledge pertaining to the water resources management. so that they are able to acquire following competencies:

1. Estimate the surface runoff from given precipitation data.
2. Explain various survey investigations for reservoir planning
3. Design the appropriate rain water harvesting scheme and required structures for given situation.

3. SCHEME OF STUDIES AND EXAMINATIONS:

| Teaching Scheme (In Hours) | | | Total Credits (L+T+P) | Examination Scheme | | | | Total Marks |
|-------------------------------|---|---|--------------------------|--------------------|----|-----------------|----|----------------|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE | PA | ESE | PA | 150 |
| 3 | 0 | 2 | 5 | 70 | 30 | 20 | 30 | |

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

4. COURSE DETAILS

| Unit | Major Learning outcomes | Topics and Sub Topics |
|-----------------------|---|--|
| 1.INTRODUCTION | 1.1 Discuss the importance of Water Resources Management.(WRM) 1.2 Identify various agencies associated with Water Resource Management | 1.1 Scope of W.R.M. 1.2 Necessity of W.R.M. 1.3 Role of various agencies in W.R.M.: - Agriculturists - Meteorologists - Geologists - Industrialists - Scientists - Biologists - Water quality Control (Authority) - Mechanical Engg. - Electrical engg. - Economists - Social workers - NGO's - Politicians - General Public |
| 2. HYDROLOGY | 2.1 Explain Hydrological cycle 2.2 Describe various forms and types of precipitation 2.3 Explain various types of rain gauges 2.4 Compute average precipitation by various | 2.1 Define Hydrology 2.2 Hydrological cycle 2.3 Forms of precipitation 2.4 Precipitation occupancy & its types. 2.5 Measurement of rain fall 2.5.1 Rain gauges a. Non Recording b. Recording - Float type |

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| | <p>methods.</p> <p>2.5 Compute runoff using empirical formula</p> <p>2.6 Describe evaporation process</p> | <ul style="list-style-type: none"> - Tipping bucket - weighing bucket <p>2.5.2 Methods of determining average rainfall</p> <ul style="list-style-type: none"> a. Arithmetic average method b. Thiessen polygon method c. Isohytel method <p>2.5.3 Determine optimum no. of rain gauges for given catchment area.</p> <p>2.6 Runoff</p> <ul style="list-style-type: none"> 2.6.1 Factors affecting runoff 2.6.2 Runoff calculation using empirical formula only <p>2.7 Evaporation, Transpiration & Evapo - transpiration</p> <ul style="list-style-type: none"> 2.7.1 Factors affecting evaporation. |
| 3. GROUND WATER | <p>3.1 Enlist various sources of water</p> <p>3.2 Describe various terms related to ground water</p> <p>3.3 Explain various types of wells</p> <p>3.4 Discuss necessity of recharging ground water</p> <p>3.5 Describe various methods of recharging</p> | <p>3.1 Sources of water</p> <p>3.2 Importance of ground water and present scenario</p> <p>3.3 Terms related to groundwater engineering: Aquifer, Aquiclude, Aquifuge, Aquitard, porosity, Specific yield, Specific retention, storage coefficient, coefficient of permeability, coefficient of transmissibility, Yield, specific yield</p> <p>3.4 Types of well</p> <ul style="list-style-type: none"> - Open, Tube and flowing well - concept, location and importance <p>3.5 Necessity of recharging</p> <ul style="list-style-type: none"> 3.5.1 Artificial recharging as today's need. 3.5.2 Types of artificial recharge <ul style="list-style-type: none"> - Spreading method. - Pit method / khet-talavadi - Induced recharge method - Recharge well method. - Sub-surface dam. - Check dam series - Ponds - Unlined canals |

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| <p>4. STORAGE WORKS</p> | <p>4.1 Describe various surveys / investigations to be carried out in storage works including their classification</p> <p>4.2 Compute reservoir capacity and losses</p> <p>4.3 Discuss purpose of various storage zones of reservoir</p> <p>4.4 Draw cross-sections of gravity and earthen dam</p> | <p>4.1 Survey and investigations.</p> <p>a. Investigations for hydrologic data</p> <p>b. Geological data.</p> <p>c. Topographic investigations.</p> <p>d. Collection of legal data, water right.</p> <p>e. Investigation of reservoir site, land acquisition</p> <p>f. Environmental considerations</p> <p>g. Economical data - Benefit cost ratio.</p> <p>4.2 Site selection for reservoir</p> <p>4.3 Methods of estimating reservoir capacity</p> <p>4.4 Storage zones</p> <p>4.5 Reservoir losses</p> <p>4.6 Reservoir sedimentation and its control</p> <p>4.7 Classification of storage works .</p> <p>4.8 Factors for selecting type of dam</p> <p>4.9 Concept of low and high dam</p> <p>4.10 Component parts of gravity and earthen dam</p> |
| <p>5. DISTRIBUTION WORKS</p> | <p>5.1 Explain purpose of distribution works</p> <p>5.2 Differentiate between barrage and weir by means of diagram</p> <p>5.3 Describe silt control structures</p> <p>5.4 Classify canal</p> <p>5.5 Explain factors affecting canal alignment</p> <p>5.6 Discuss suitable construction techniques, materials & equipments for "canal lining."</p> | <p>5.1 Purpose of distribution works</p> <p>5.2 Component parts & sketches.</p> <p>5.3 Barrage.</p> <p>5.4 Weir</p> <p>5.4.1 Comparison of weir and barrage.</p> <p>5.4.2 Causes of failure of weir and remedial measures</p> <p>5.5 Safe exit gradient</p> <p>5.6 Control of silt entry</p> <p>Scouring sluices, silt excluder, silt ejector, head regulator.</p> <p>5.7 Classifications of canal</p> <p>-Ridge and contour</p> <p>- Functions of each according to network.</p> <p>- Line diagram of network of canal.</p> <p>5.8 Canal Alignment</p> <p>- Factors influencing canal alignment .</p> <p>5.9 Regime & semi-regime conditions.</p> <p>5.10 Canal lining.</p> <p>- Advantages.</p> <p>- Types of canal lining materials</p> |

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| | | <ul style="list-style-type: none"> - Methods of canal lining. 5.11 Regulation works. 5.12 C.D. Works. -Types , functions & sketches 5.13 Outlets. - types, situation, functions & sketches 5.14 Water-logging, effects, causes & prevention |
| 6. WATERSHED DEVELOPMENT | <p>6.1 Describe important characteristics of "water shed"</p> <p>6.2 Discuss people's participation in watershed management</p> | <p>6.1 Explain watershed concept</p> <p>6.2 Characteristic of watershed, size, shape, physiography, slope, climate, drainage, land use, vegetation, geology, hydrology, hydrogeology, socio-economics.</p> <p>6.3 Watershed management & people's participation..</p> <p>6.4 Role of co-operative society in watershed management.</p> |
| 7. WATER HARVESTING STRUCTURES | <p>7.1 Describe necessity and importance of rain water harvesting .</p> <p>7.2 Discuss various Rain water harvesting methods, structures and appropriate suitability.</p> | <p>7.1 Necessity of Rain water harvesting</p> <p>7.2 Importance of Rain water harvesting</p> <p>7.3 Rain water harvesting methods</p> <ul style="list-style-type: none"> - Check dams. - Nala / Gully plugging - Percolation tank. - Khet-talawadi - Roof harvesting - Vegetation and plantation |

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

| Unit | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|------|--------------|----------------|------------------------------|---------|---------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| 1 | INTRODUCTION | 3 | 2 | 3 | 2 | 7 |
| 2 | HYDROLOGY | 8 | 4 | 3 | 7 | 14 |
| 3 | GROUND WATER | 7 | 3 | 5 | 6 | 14 |

| Unit | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|------|-----------------------------|----------------|------------------------------|-----------|-----------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| 4 | STORAGE WORKS | 8 | 3 | 4 | 7 | 14 |
| 5 | DISTRIBUTION WORKS | 6 | 2 | 2 | 3 | 7 |
| 6 | WATER SHED DEVELOPMENT | 6 | 3 | 2 | 2 | 7 |
| 7 | WATER HARVESTING STRUCTURES | 4 | 3 | 2 | 2 | 7 |
| | | 42 | 20 | 21 | 29 | 70 |

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The assignments/practical/exercises should be properly designed and implemented with an attempt to reinforce theoretical knowledge so that students are able to acquire the competence in comprehending and managing water resources. Following is the list of assignments/exercise/experiments for guidance.

| S. No. | Unit No. | Practical/Exercise | Apprx. Hrs. Required |
|--------|----------|--------------------|----------------------|
| 1 | | Sketches : | Home Work |
| | II | Hydrological Cycle | |

| S. No. | Unit No. | Practical/Exercise | Apprx. Hrs. Required |
|--------|----------|---|----------------------|
| | II | Types of Precipitation | |
| | II | Rain gauges | |
| | III | Various methods of artificial recharge | |
| | IV | Component parts of earthen and Gravity dam | |
| | V | Diversion head works | |
| | V | Cross Drainage Works | |
| | VII | Various types of rainwater harvesting structures | |
| 2 | | Solve Numerical from given data: | 12 |
| | II | Calculate average precipitation for given catchment area using various methods. | |
| | II | Calculate Runoff for given catchment area using empirical formula . | |
| | II | Compute optimum number of rain gauges for given catchment area. | |
| | III | Compute yield of well | |
| | VII | Design of check dam | |
| 3 | | Field Visit and Report : | 08 |
| | I | Arrange field Visit to irrigation / W.R.I department for collecting existing W.R. data of your district with respect to Importance and necessity of WRM | |
| | II | Visit of meteorological department, collect precipitation data, observe, and interpret . | |
| | | Collect data of your district regarding various types of water sources available and prepare a report | |

| S. No. | Unit No. | Practical/Exercise | Apprx. Hrs. Required |
|--------|----------|---|----------------------|
| | | Suggest various methods of Artificial recharge of ground water in your district | |
| | | Collect data of various storage works in your district | |
| | | Visit to water harvesting Structure near by your polytechnic and prepare a report | |
| 4. | | Seminar | 04 |
| | I to VII | Select one topic as a Seminar and present it using modern teaching aids before teachers & students. | |

7. SUGGESTED STUDENT ACTIVITIES

1. Prepare prototype/ model of rainwater harvesting structure in the polytechnic/ suggested premises.

8. SUGGESTED LEARNING RESOURCES

(A) List of Books:

| S. No. | Title of Books | Author | Publication |
|--------|---|----------------|---|
| 1. | Irrigation, Water Resources & Water Power Engg. | Dr. P.N. Modi | Standard Book House, Delhi. |
| 2. | Hydrology & Water Resources | R.K. Sharma | Dhanpat Rai & Sons, Delhi. |
| 3. | Ground water assessment, Development & management | K.R. Karanth | Tata Mc Graw Hill Pub. Co. Ltd., New Delhi. |
| 4. | Ground water | H.M.Ragunath | New Age international Ltd., New Delhi. |
| 5. | Hydrology & Water Resources Engg. | S.K.Garg | Khanna Pub., Delhi. |
| 6. | Watershed management in India | J.V.S. Moorthy | Wiley Eastern Ltd. |
| 7. | Design of small dams. | U.S.B.R. | |

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| 8. | Irrigation theory & practice | A.M.Mitchel | Vikas Pub. House Pvt. Ltd, Delhi. |
| 9. | Water vision 2050 Narmada | W.R. & water supply deptt., Gandhinagar | |
| 10. | Water Resources Engg- Principles & Practice | C. Satyanarayan Murthy | New Age International Ltd., New Delhi |
| 11. | Relevant IS codes | | |

(B) List of Major Equipment/Materials:

1. Rain gauge
2. Working models of storage works
3. Models of cross drainage works
4. Models of rain water harvesting structures.

(C) List of Software/Learning Websites

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

1. S. M. Mistry, H.O.D.-Civil Engg, Dr. S. & S. S. Ghandhy College of Engg and Tech., Surat
2. P. N. Patel, Sr.Lecturer, Civil Engg Deptt., G. P. Dahod
3. A. K. Popat, Sr.Lecturer, Civil Engg Deptt., G. P. Dahod
4. D. V. Jariwala, Lecturer, Civil Engg Deptt., G.P.Valsad

Coordinator and Faculty Members from NITTTR, Bhopal