

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: 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 “Nature’s greatest gift”. Our water requirement is rapidly increasing due to vast industrial development, population growth and changing life style. We are mostly dependent on rains as a predominant source of water. The other important source of water is the ground water which also depends to great extent on rainfall in previous years. We know that ground water table is declining rapidly due to its excessive use and misuse and also due to insufficient rainfall every year. 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 emphasis on certain aspects of water resources management. The topics viz. hydrology, runoff, watershed management, recharging etc. have been specifically dealt in the curriculum.

2. COMPETENCY:

The course content should be taught and the curriculum should be implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Design the appropriate rain water harvesting scheme and required structures for managing water resources under given conditions**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Discuss basic concepts of “Water Resources Management”.
- Estimate the surface runoff from given precipitation data.
- Describe various types of survey investigations for reservoir planning
- Design the appropriate rain water harvesting scheme and required structures for given conditions.

4. SCHEME OF STUDIES AND EXAMINATIONS:

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			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

5. COURSE DETAILS

Unit	Major Learning outcomes (in cognitive domain)	Topics and Sub Topics
Unit- I Introduction	1a. Discuss the concepts and importance of Water Resources Management (WRM). 1b. 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
Unit-II Hydrology	2a. Explain Hydrological cycle. 2b. Describe various forms and types of precipitation. 2c. Explain various types of rain gauges. 2d. Compute average precipitation by various methods. 2e. Compute runoff using empirical formula. 2f. Describe evaporation process and factors	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 Non Recording Recording - Float type - Tipping bucket - weighing bucket 2.5.2 Methods of determining average rainfall b. Arithmetic average method

	affecting it.	<p>c. Thiessen polygon method d. Isohytel method</p> <p>2.5.3 Determine optimum no. of rain gauges for given catchment area.</p> <p>2.6 Runoff</p> <p>2.6.1 Factors affecting runoff 2.6.2 Runoff calculation using empirical formula only</p> <p>2.7 Evaporation, Transpiration & Evapo - transpiration</p> <p>2.7.1 Factors affecting evaporation.</p>
Unit-III Ground Water	<p>3a. Identify various sources of water.</p> <p>3b. Describe various terms related to “ground water”</p> <p>3c. Explain various types of wells with their features.</p> <p>3d. Discuss necessity of recharging ground water.</p> <p>3e. Describe various methods of recharging ground water.</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> <p>3.5.1 Artificial recharging as today’s need.</p> <p>3.5.2 Types of artificial recharge</p> <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
Unit-IV Storage Works	4a. Describe various surveys / investigations to be carried out in storage works including their classification.	<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>4b. Compute reservoir capacity and losses.</p> <p>4c. Discuss purpose of various storage zones of reservoir.</p> <p>4d. Draw cross-sections of gravity and earthen dam at various points.</p>	<p>e. Investigation of reservoir site, land acquisition Environmental considerations</p> <p>f. 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>Unit-V Distribution Works</p>	<p>5a. Explain purpose of distribution works</p> <p>5b. Differentiate between barrage and weir by means of a diagram</p> <p>5c. Describe silt control structures</p> <p>5d. Classify canals based on their functions.</p> <p>5e. Explain factors affecting canal alignment</p> <p>5f. Discuss suitable construction techniques, materials & equipments for "canal lining."</p> <p>5g. Explain the causes, effects & prevention of water logging.</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 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 Factors influencing canal alignment .</p> <p>5.9 Regime & semi-regime conditions.</p> <p>5.10 Canal lining.</p> <p>a. Advantages.</p> <p>b. Types of canal lining materials</p> <p>c. Methods of canal lining.</p> <p>5.11 Regulation works.</p> <p>5.12 C.D. Works. -Types , functions & sketches</p> <p>5.13 Outlets. - types, situation, functions & sketches</p> <p>5.14 Water-logging, effects, causes &</p>

		prevention
Unit –VI Watershed Development	6a. Describe important characteristics of "water shed". 6b. Evolve strategies of enhancing people's participation in watershed management.	6.1. Concept of 'watershed' 6.2. Characteristic of watershed, size, shape, physiography, slope, climate, drainage, land use, vegetation, geology, hydrology, hydrogeology, socio-economics. 6.3. Watershed management & people's participation.. 6.4. Role of co-operative society in watershed management.
Unit-VII Water Harvesting Structures	7a. Describe necessity and importance of rain water harvesting . 7b. Discuss various 'rain water harvesting' methods, structures and their suitability in various conditions.	7.1 Necessity of Rain water harvesting 7.2 Importance of Rain water harvesting 7.3 Rain water harvesting methods - Check dams. - Nala / Gully plugging - Percolation tank. - Khet-talawadi - Roof harvesting - Vegetation and plantation

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I.	Introduction	3	2	3	2	7
II.	Hydrology	8	4	3	7	14
III.	Ground Water	7	3	5	6	14
IV.	Storage Works	8	3	4	7	14
V.	Distribution Works	6	2	2	3	7
VI.	Water Shed Development	6	3	2	2	7
VII.	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 a general guideline for students and teachers.

The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx Hrs. Required
1		Draw the following Sketches :	
	II	Hydrological Cycle	16
	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 a well	
	VII	Design a 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	

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx Hrs. Required
	II	Visit to meteorological department, collect precipitation data, observe, and interpret.	
		Collect data of your district regarding various types of water sources available and prepare a report	
		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 nearby 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.	
Total Hours			40

8. SUGGESTED STUDENT'S ACTIVITIES

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

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Show the video/animation films of various types of dams and their structures.
- ii. Arrange visit to nearby water bodies

10. 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	Willey Eastern Ltd.
7.	Design of small dams.	U.S.B.R.	
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:

- i. Rain gauge
- ii. Working models of storage works
- iii. Models of cross drainage works
- iv. Models of rain water harvesting structures.

(C) List of Software/Learning Websites

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

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

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. V. H. Radhakrishnan**, Professor, Department of Civil and Environmental Engineering
- **Prof M. C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering