

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**

**COURSE TITLE: ADVANCED HYDROLOGY  
(COURSE CODE: 3360610)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Civil Engineering	Sixth

**1. RATIONALE:**

Hydrology is the science of water that deals with occurrence, circulation and distribution of water on the earth. Hydrological and meteorological data is useful to design water resources projects, structures and flood management. Hydrological study is useful for the students for planning and design water resources structures like dams, etc. The students should also know about flood and how to manage it. Thus this course is an important course for civil engineers working in the area of water resource management.

**2. COMPETENCY:**

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competencies:

- **Plan for management of water resources and floods based on analyse of the rainfall & hydrological data using the principles of hydrology.**

**3 COURSE OUTCOME:**

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

- Apply techniques for hydrology study.
- Measure and analyse the rainfall data..
- Explain evaporation, transpiration and Infiltration .
- Measure runoff.
- Explain methods to manage floods

**4. TEACHING AND EXAMINATION SCHEME**

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

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

## 5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in Cognitive Domain)	Topics and Sub-topics
<b>Unit-I Introduction</b>	1.1 Explain Hydrology 1.2 Describe techniques used in hydrology	1.1 Define various terms related to Hydrology and Advanced Hydrology 1.2 Applications of hydrology 1.3 India's Water Resources 1.4 Water budget equation 1.5 Introduction to Modern Techniques for hydrology study - Remote sensing - Geographical Information System (GIS) 1.6 Explain hydro meteorological parameter
<b>Unit-II Rainfall Measurement and its Analysis</b>	2.1 Describe Automatic rain gauge 2.2 Explain missing rainfall Data 2.3 Explain presentation of Rainfall data 2.4 Calculate missing rainfall data	2.1 Automatic rain gauge - Necessity, advantages and use 2.2 Estimating Missing Rainfall data 2.3 Presentation of Rainfall data - Hyetograph method - Mass curve of rainfall method
<b>Unit-III Evaporation and Transpiration</b>	3.1 Describe Evaporation & Transpiration 3.2 Explain measurement of Evaporation 3.3 Explain measurement of Transpiration 3.4 Solve problems on evaporation	3.1 Define : Evaporation, Transpiration, Evapotranspiration, Potential Evapotranspiration, 3.2 Explain methods of estimation of evaporation 3.3 Explain methods of actual measurement of evaporation 3.4 Control of evaporation from a reservoir. 3.5 Explain transpiration measurement 3.6 Factors affecting Evapotranspiration 3.7 Numerical problems on evaporation

<b>Unit</b>	<b>Major Learning Outcomes</b> (in Cognitive Domain)	<b>Topics and Sub-topics</b>
<b>Unit-IV</b> <b>Infiltration</b>	4.1 Describe Infiltration 4.2 Describe measurement of infiltration 4.3 Calculate infiltration indices	4.1 Define Infiltration, Infiltration rate, Infiltration capacity, Soil moisture, Field capacity 4.2 Explain process of infiltration 4.3 Factors affecting infiltration 4.4 Explain infiltration capacity curve. 4.5 Explain Measurement of infiltration 4.6 Infiltration Indices
<b>Unit-V</b> <b>Hydrograph and its Analysis</b>	5.1 Explain hydrograph 5.2 Explain hyetograph 5.3 Explain Runoff 5.4 Explain unit Hydrograph 5.5 Solve problems on hydrograph	5.1 Definition , units, area of hydrograph, hydrograph for isolated storm, complex storm 5.2 Explain Hyetograph 5.3 Explain Runoff Types and Factors affecting runoff 5.4 Analysis of hydrograph 5.5 Explain Components of hydrograph 5.6 Explain Separation of base flow 5.7 Explain Unit Hydrograph 5.8 Explain Derivation of unit hydrograph - assumptions, limitations & Uses 5.9 Explain in brief S-Hydrograph, Synthetic unit hydrograph and Instantaneous unit hydrograph 5.10 Examples on hydrograph.
<b>Unit-VI</b> <b>Flood Management</b>	6.1 Explain flood Management 6.2 Examples on flood Estimation 6.3 Explain flood routing	6.1 Definition and Describe Causes of flood 6.2 Factors affecting flood 6.3 Classify floods 6.4 Explain Flood Estimation methods - Estimating the observed flood & increasing it by certain percentage - Envelope curves method - Empirical formulae - Unit Hydrograph method - Flood frequency method - Gumbel's method 6.5 Explain Methods of flood control 6.5 Explain Flood mitigation measures 6.6 Explain Flood damage analysis 6.7 Explain Flood preparedness, Relief and recovery 6.8 Explain Flood plain zoning and flood losses.

## 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	4	4	3	0	7
II	Rainfall measurement and its analysis	4	3	4	0	7
III	Evaporation and Transpiration	8	5	4	5	14
IV	Infiltration	8	4	5	5	14
V	Hydrograph and its Analysis	10	4	4	8	16
VI	Flood Management	8	4	3	5	12
<b>Total</b>		<b>42</b>	<b>24</b>	<b>23</b>	<b>23</b>	<b>70</b>

**Legends:** R = Remember, U = Understand, A= Apply and above level (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 mainly 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.*

<b>Sr. No.</b>	<b>Unit No.</b>	<b>Practical/Exercise</b> (outcomes in psychomotor domain)	<b>Approx. Hours Required</b>
1.		<b>Sketches</b>	04
	II	Sketch Symon's non-recording type raingauge	
	II	Sketch Recording type raingauge	
	IV	Sketch U.S. Class A Evaporation pan, lysimeter	
	IV	Sketch Infiltrometer	
	V	Sketch Elements of hydrograph	
	VI	Sketch Price's current- meter	
2		<b>Solve numerical from given data :</b>	10
	III	Examples to find evaporation	
	IV	Examples related to infiltration	
	V	Examples related to Hydrograph	
	VI	Examples related to flood estimation	
3		<b>Field visit &amp; Report :</b>	10
	II	Visit to meteorological department, collect precipitation data , observe & interpret and prepare a report.	
	V	Arrange visit to Irrigation department/water resource department and collect hydrological data & interpret.	
	V	Arrange visit to storage works and collect hydrological data & interpret	
4		<b>Seminar :</b>	
	ALL	Select one topic and collect latest information about it and present it using modern teaching aids before teachers & students	04
<b>Total Hours</b>			<b>28</b>

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Prepare a model/prototype of hydraulic structure in the college/suggested premises
- ii. Prepare a model/prototype of storage works in the suggested premises.
- iii. Explore internet to study advances related to hydrology and prepare a report.
- iv. Prepare a report on water logging in recent past in some locality of your city due to heavy rains and suggest measures to avoid such logging in future.

**9. SPECIAL INSTRUCTIONAL STRATEGIES ( If Any )**

- i. Show video films on causes of floods, it's devastating effects and mitigating techniques.
- ii. Arrange expert lectures of engineers working in irrigation department on relevant issues.
- iii. Present case studies of success and failures in flood management.

**10. SUGGESTED LEARNING RESOURCES****A. BOOKS :**

No.	TITLE	AUTHOR	PUBLISHER
1	Hydrology&WaterResources Engg.	S.K.Garg	KhannaPub., Delhi.
2	Hydrology&WaterResources	R.K. Sharma	DhanpatRai& sons,Delhi.
3	Elementary Engineering Hydrology	M. J. Deodhar	Dorling Kindersley(India) Pvt. Ltd.
4	Irrigation, WaterResources & WaterPower Engg.	Dr. P.N. Modi	Standard Book House, Delhi.
5	Ground water	H.M.Ragunath	New Ageinternational Ltd.,
6	Hydrogeology	S.N.Davis& R.J.M. deweist	John wiley&sons,Newyork
7	Hydrogeology	K.R.Karant	Tata MacGraw Hill Co.Ltd.
8	Irrigation Engineering	B.C.Punamia	

**B. List of Major Equipment/Materials**

- i. Working models of storage works.
- ii. Models of rain water harvesting structures

**C List of Software/Learning Websites**

- i. [www.nptel.ac.in](http://www.nptel.ac.in)
- ii. [www.aboutcivil.org](http://www.aboutcivil.org)
- iii. [www.nih.ernet.in](http://www.nih.ernet.in)
- iv. [www.nih.ernet.in/hyd\\_res\\_web.html](http://www.nih.ernet.in/hyd_res_web.html)
- v. [www.indiawaterportal.org](http://www.indiawaterportal.org) > Articles
- vi. [wrmin.nic.in](http://wrmin.nic.in)
- vii. [www.groundwaterinternational.co](http://www.groundwaterinternational.co)
- viii. [www.cgwb.gov.in](http://www.cgwb.gov.in)

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculties from Polytechnics, Gujarat**

- **Prof. M. J. Zala**, Lecturer, B & B Institute of Technology, V.V.Nagar.
- **Dr. S.K. Dave**, Lecturer, I/C Head Civil Engg. Dept. (S.F.), B & B Institute of Technology, V.V.Nagar.
- **Prof. V. K. Shah**, Lecturer, DR S&SS Gandhi Engg College, Surat
- **Prof. Rina K. Chokshi**, Head, Parul Institute of Engineering & Technology (Diploma Studies)

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Prof. M.C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering.
- **Prof. S. Roy**, Professor, Department of Civil and Environmental Engineering.