

# **WATER RESOURCES ENGINEERING-II**

Subject Code: **A70133**

Regulations: R15 - JNTUH

Class : IV Year B.Tech CE I Semester



**Department of Civil Engineering**

**BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY**

Ibrahimpatnam - 501 510, Hyderabad

## **WATER RESOURCES ENGINEERING-II (A70133) COURSE PLANNER**

### **I. COURSE OVERVIEW:**

This course address the concept of dam, earth dam, gravity dam, canals structures, diversion head works, spillways and drainages works, constitutes to be the most common type, Since it is

generally built of locally available in their natural state with a minimum of processing .The responsibility of maintenance of the distributing channel and the whole canal networks lies with government, while that of the field channel lies with the farmers. Know about canal regulation works. Ground water, reservoir water and rain water storing

**II. PREREQUISITE(S):**

Level	Credits	Periods	Prerequisite
UG	4	5	Water Resources Engineering-I

**III. COURSE OBJECTIVES:**

**The objective of the teacher is to impart knowledge and abilities to the students to:**

- I. **Understand** the structure of the dams, earth dam, canals, spillways and cross drainage works.
- II. **Learn** how to estimate the capacity of reservoir using mass curve. .
- III. **Classify** the types of water fall from the canals.
- IV. **Design** the principle of Sarda type, trapezoidal notch, straight glacis fall.
- V. **Determine** the uplift pressure, impervious floors using the theory.

**IV. COURSE OUTCOMES:**

**After completing this course the student must demonstrate the knowledge and ability to:**

- 1. **Understand** different terminology related to water resources engineering.
- 2. **Identify** various types of reservoir and their design aspects
- 3. **Design** various channel systems.
- 4. **Design** head and cross regulator structures.
- 5. **Establishes** the understanding of cross drainage works and its design.
- 6. **Design** different types of dams
- 7. **Apply** math, science, and technology in the field of water resource Engineering.

**V. HOW PROGRAM OUTCOMES ARE ASSESSED:**

Program outcomes		Level	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exams
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	H	Assignments, Exams
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Assignments
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Assignments
PO5	Modern tool usage: Create, select, and apply appropriate	-	-

	techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.		
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	H	Exams
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	S	Exams, Assignments
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Quizzes, Discussions
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Lectures, Discussions
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Lectures, Discussions
PO11	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Possible Projects
PO12	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Discussions

## VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program specific outcomes		Level	Proficiency Assessed By
PSO1	<b>ENGINEERING KNOWLEDGE:</b> Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	H	Lectures, Assignments, Exams
PSO2	<b>BROADNESS AND DIVERSITY:</b> Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	H	Lectures, Assignments, Exams
PSO3	<b>SELF-LEARNING AND SERVICE:</b> Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	S	Guest Lectures, Possible Group Projects, Industrial Internship

## VII. SYLLABUS:

### UNIT – I:

Storage works-Reservoirs-Types of reservoirs, selection of site for reservoir, Zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve-Reservoir Sedimentation-Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

### UNIT – II:

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety – Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.

### UNIT – III:

Earth dams: types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage.

Spillways: types of spillways, Design principles of Ogee spillways-Spillway gates. Energy Dissipaters and Stilling Basins. Significance of Jump height, Curve and Tail water rating Curve – USBR and Indian types of Stilling Basins.

### UNIT – IV:

Diversion Head works: Types of Diversion head works-weirs and barrages, layout of diversion head work – Components, Causes and failure of Weirs and Barrages on permeable foundation, -Silt ejectors and Silt Excluders.

Weirs on Permeable foundations-Creep Theories-Bligh's, Lane's and Khosla's theories, Determination of uplift pressure-Various Correction factors-Design principles of weirs on

permeable foundations using Creep theories-exit gradient/s and D/s Sheet piles-Launching Apron.

**UNIT-V:**

Canal Falls-types of falls and their location, Design principle of Notch fall and Sarada type fall. Canal regulation works, principles of design of distributory and head regulators, Canal Cross Regulators-Canal outlets, types of canal modules, Cross Drainage works: types, selection of site, Design principles of aqueduct, siphon aqueduct and super passage.

**SUGGESTED BOOKS:**

**TEXTBOOKS:**

1. Irrigation engineering and hydraulic structures by S.K Garg, Khanna publishers.
2. Irrigation and water power engineering by punmia&Lal, Laxmi publications pvt. Ltd. New Delhi.

**REFERENCE BOOKS:**

1. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers
2. Theory and Design by of Hydraulic structures by Varshney, Gupta & Gupta
3. Irrigation engineering by K.R Arora.
4. Irrigation Engineering by R.K Sharma and T.K sharma , S. Chand Publishers.
5. Introduction to hydrology by Warren Viessvann, Jr, Garyl. Lewis, PHI
6. Engineering Hydrology by CS pojha, R. Berndtsson and P.Bhunya, Oxford University Press.

**NPTEL WEB COURSE:**

<http://nptel.ac.in/downloads/105105110/>

**NPTEL VIDEO COURSE:**

<http://nptel.ac.in/downloads/105105110/>

**GATE SYLLABUS:**

**Fluid Mechanics and Hydraulics:** Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

**Hydrology:** Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

**Irrigation:** Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

**IES SYLLABUS:**

Water resources of the globe: Multipurpose uses of Water: Soil-Plant-Water relationships, irrigation systems, water demand assessment; Storages and their yields, ground water yield and well hydraulics; Waterlogging, drainage design; Irrigation revenue; Design of rigid boundary canals, Lacey's and Tractive force concepts in canal design, lining of canals; Sediment transport in canals; Non-Overflow and overflow sections of gravity dams and their design, Energy dissipators and tailwater rating; Design of headworks, distribution works, falls, cross-drainage works, outlets; River training.

### VIII. COURSE PLAN:

Lecture No	Week	Unit	Topics to be covered	Learning Objective	References
1.	1	1	Storage Works Reservoirs	To know the types of Reservoir	T1: 1.1-3, 2.1-5
2.	1	1	Types of Reservoirs, zones of storage of a reservoirs		
3.	1	1	Reservoir yield , estimation of capacity of reservoirs using mass curve	Able to know the selection of site for reservoir. Zones of storage and reservoir yield	T1: 2.4
4.	1	1			
5.	2	1	Reservoir sedimentation – Life of Reservoir	Able to know life of Reservoir	T1: 2.6-14
6.	2	1			
7.	2	2	Types of dams, factors governing selection of site for a dam.	Able to understand the factors governing selecting site for dam.	T1: 2.15-20
8.	2	2			
9.	3	2	Forces acting on gravity dam, causes of failure of gravity dam.	Able to know about gravity dam and forces action on its.	T1: 3.1-.3
10.	3	2			
11.	3	2	Elementary profile and practical profile of a gravity dam	To understand about Elementary profile and practical profile of a gravity dam	T1: 3.5-14
12.	3	2			
13.	4	2	Limiting height of gravity dam, factors of safety- stability analysis	Able to know limiting height of gravity dams.	T1: 6.1-5
14.	4	2			
15.	4	2	Foundation for a gravity dam, Drainage and inspection galleries	Able to know the foundation of gravity dams	T1: 9.1-5
16.	4	2			
17.	5	3	Types of earth dams, Causes and failure of earth dams	To know about earth dams and its types	T1: 9.6-7
18.	5	3			
19.	5	3			
20.	5	3	Criteria for safe design of earth dam. method	An able to design the criteria for safe design of earth dams	T1: 9.6-7
21.	6	3			
22.	6	3			
23.	6	3	Seepage through earth dam- graphical method	Able to design earth dam through dam- graphical method	T1: 9.6-7
24.	6	3			
25.	7	3			

26.	7	3	Measures for control of seepage	Able to measure for control for seepage	T1:9.6-11
27.	7	3	Types of spillways, Design principles of ogee spillways- spill gates,	To know about the spillways and its types	T1: 10.1-5
28.	7	3			
29.	8	3	Energy dissipaters and stilling basins. Significance of Jump Height Curve and Tail Water Rating curve	Able to know the Significance of Jump height Curve and Tail Water Rating curve.	T1: 10.5-7
30.	8	3			
31.	8	3	UBBR and Indian types of stilling basin	Able to know the Indian types of stilling basins	T1: 10.7
32.	8	3			
33.	9	4	Types of Diversion head works- weirs and barrages	Able to know the types of Diversion head works- weirs and barrages	T1: 10.
34.	9	4			
35.	9	4	Layout of diversion head work- components.	Able to Design the diversion head works components.	T1: 11.1-7
36.	9	4			
37.	10	4			
38.	10	4			
39.	10	4	Causes and failure of weirs and barrages on permeable foundations	To understand the causes and failure of weirs and barrages	T1: 4.1
40.	10	4	Silt Ejectors and silt Excludes	Able to know about silt ejectors and silt Excludes	T1: 4.2 - 4.11
41.	11	4			
42.	11	4			
43.	11	4	Weirs on Permeable foundations- creep theories	Able to understand permeable foundations through creep theories	T1: 5.1-8
44.	11	4			
45.	12	4			
46.	12	4	Bligh's Lane's and Khosla's theories, determinations of uplift pressure	To know bligh's theories, able to understand the Khosla's theory. And able to understand uplift pressure.	T1: 7.1-3
47.	12	4			
48.	12	4	Various correction factors- Design principles of weirs on permeable foundations using creep theories.	To understand various correction factors. And design principles of weirs on foundations	T1: 7.4-7
49.	13	4			
50.	13	4			
51.	13	5	Canal fall- types of falls and their location, Design principles of notch fall and Sarda type fall.	To know about the type of falls and their location and able to design principles of notch fall and sarda type fall.	T1: 12.1-3
52.	13	5			T1: 12.1-3
53.	14	5	Canal regulation works, principles of design of distributor and head regulators	To understand canal regulation works	T1: 12.4-11
54.	14	5			
55.	14	5	Canal cross regulators- canal outlets	Able to understand the canal cross regulators	T1: 13.1-9
56.	14	5			

57.	15	5	Type of canal modules, proportionality, sensitivity and flexibility	To know about the types of canal modules, Proportionality sensitivity and flexibility	T1: 14.1-8
58.	15	5			
59.	15	5	Cross Drainage works: types selection of site.	To know about cross drainage works and its types and selection of sites	T1: 15.4-11
60.	15	5			
61.	16	5	Design principles of aqueduct,	To understand about design principles of aqueduct.	T1: 13.1-9
62.	16	5	Siphon aqueduct and super passage.	To understand siphon aqueduct and super passage	T1: 14.1-8
63.	16	5	Design of type II Aqueduct (under Tunnel)	Able to design of type II Aqueduct	T1: 12.4-1
64.	16	5			

**IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

Course Objectives	Program Outcomes					Program Specific Outcomes									
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>I</b>	<b>S</b>	<b>H</b>											<b>H</b>		<b>S</b>
<b>II</b>	<b>H</b>	<b>S</b>											<b>H</b>	<b>S</b>	
<b>III</b>				<b>H</b>			<b>S</b>						<b>H</b>	<b>S</b>	
<b>IV</b>											<b>S</b>		<b>S</b>	<b>H</b>	
<b>V</b>			<b>H</b>	<b>S</b>						<b>S</b>			<b>S</b>	<b>H</b>	<b>S</b>

**X. QUESTION BANK: (JNTUH)**

**UNIT-I  
SHORT ANSWERS**

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Give the classification of reservoirs.	Remember	1
2	Discuss the steps involved in selecting a site for reservoir construction.	Understand	1
3	Write brief notes on reservoir yield.	Remember	1
4	Explain various levels of a reservoir with neat sketch.	Understand	1
5	Write short notes on mass curve and demand curve	Understand	1
6	Explain how reservoir capacity can be determined using a mass curve.	Remember	1
7	What is meant by reservoir sedimentation	Remember	1
8	List out the factors affecting sedimentation.	Remember	1
9	List out the control measures for sedimentation	Understand	1
10	What do you understand by the term life of reservoir	Remember	1

## LONG ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1.	What is meant by reservoir sedimentation and life of a reservoir?	Remember	1
2.	Give the classification of reservoirs.	Understand	2
3.	Write short notes on gravity dam and buttress dam.	Remember	1
4.	Discuss the steps involved in selecting a site for reservoir construction.	Understand	2
5.	Explain the procedure to determine reservoir capacity using a mass curve.	Understand	3
6.	Explain the purpose of Flood Control Reservoir?	Remember	1
7.	Write about Distribution reservoir	Remember	1
8.	Explain about Reservoir Losses	Remember	1
9.	What is the purpose of constructing dam?	Understand	1
10.	Give the classification of dams.	Remember	2

## UNIT-II SHORT ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Explain the forces acting on a gravity dam.	Understand	3
2	Draw an elementary profile of a gravity dam.	Remember	3
3	Draw the practical profile of a gravity dam.	Understand	3
4	Write the effects of earthquake forces on a gravity dam.	Understand	3
5	Explain the failure of a gravity dam due to overturning.	Understand	3
6	Explain the failure of a gravity dam due to sliding.	Understand	3
7	Explain the failure of a gravity dam due to crushing.	Remember	3
8	Derive the limiting height of a gravity dam.	Understand	3
9	What are the modifications given to an elementary profile to get practical profile?	Understand	3
10	Explain the effect of wave pressure on gravity dam.	Remember	3

## LONG ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Define the following parameters with respect to the gravity dam, (a) Dam base line (b) Structural height	Understand	1
2	Write detailed notes on elementary and practical profiles of gravity dams.	Understand	1
3	Enumerate various methods of stability analysis of gravity dam. Explain any two of them.	Understand	1
4	A concrete gravity dam 20 m in height has top width 6 m and free board 2.5 m, upstream face is vertical, while downstream face has a slop of 0.6 H:1 V right from top to bottom. Check the stability of the dam. Take specific weight of concrete as 2.4 t/m <sup>3</sup> consider full uplift. There is no tail water. Assume any other data not given.	Understand	1
5	What are the main points to be considered while selecting a site for a gravity dam construction?	Understand	1
6	Derive limiting height of a gravity dam	Understand	1
7	Write the effects of earthquake forces on a gravity dam.	Understand	1
8	Explain the failure of a gravity dam due to crushing.	Remember	1
9	What are the modifications given to an elementary profile to get practical profile?	Understand	1
10	Explain the forces acting on a gravity dam.	Understand	1

## UNIT-III

### SHORT ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	What are the types of embankment dams?	Understand	4
2	Explain various earth dams classified based on the materials used	Understand	4
3	Explain various types of earth dams classified based on methods of construction.	Remember	4
4	Explain the hydraulic failures of earth dams.	Understand	4
5	Explain seepage failures of earth dams.	Remember	4
6	Explain the structural failures of earth dams	Understand	4
7	Give brief description of phreatic line of an earth dam.	Understand	4
8	Write the criteria for safe design of earth dams.	Understand	4
9	Write short notes on rolled type earth dams.	Understand	4
10	Write short notes on zoned type earth dams.	Remember	4

## LONG ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Explain earth dams with neat sketch.	Remember	4
2	Write short notes on, (a) Hydraulic failures of earthen dams (b) Significance of pore pressure in relation to earthen dam construction (c) Slope protection in earthen dams (d) Filters in earthen dams.	Understand	4
3	Write briefly about overtopping, wave erosion and piping phenomenon in earthen dams.	Remember	4
4	Explain the design criteria for dams.	Understand	4
5	What is phreatic line? Explain its significance in earthen dams.	Remember	4
6	Explain the structural failures of earth dams	Understand	4
7	Give brief description of phreatic line of an earth dam.	Understand	4
8	Write the criteria for safe design of earth dams.	Understand	4
9	Write short notes on rolled type earth dams.	Understand	4
10	Write short notes on zoned type earth dams.	Remember	4
11	What are the requirements of spillways? What are the factors which affect the spillway capacity? Explain various components of spillway briefly.	Remember	5

## SHORT ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Give a brief note on diversion headwork.	Understand	6
2	Distinguish between weir and a barrage.	Understand	6
3	Give the classification of weirs.	Understand	6
4	Draw a neat sketch of layout of a diversion headwork.	Remember	6
5	Mention various components of a diversion headwork.	Understand	6
6	Explain the functions of canal head regulator.	Remember	6
7	Give the necessity of providing silt excluder.	Understand	6
8	What is the purpose of providing a divide wall in a diversion headwork?	Remember	6
9	Give the necessity of providing silt ejector inside a canal..	Understand	6
10	What are guide banks and marginal banks?	Understand	6

## LONG ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	What is the difference between diversion head works and a storage head works (dam) ? What considerations will you	Understand	6
2	Explain clearly the difference between barrage and weir.	Remember	6
3	Write a short notes on the following, (a) Dropping shutters.(b) Stop logs Also draw the relevant sketches.	Remember	6
4	Explain different causes of weirs or barrages on the regimes of river.	Remember	6
5	Explain the functions of various components of a diversion work.	Understand	6
6	Explain the functions of canal head regulator.	Remember	6
7	Give the necessity of providing silt excluder.	Understand	6
8	What is the purpose of providing a divide wall in a diversion headwork?	Remember	6
9	Give the necessity of providing silt ejector inside a canal..	Understand	6
10	What are guide banks and marginal banks?	Understand	6

## SHORT ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	What are the different types of cross drainage works necessary on canal alignment?	Understand	6,7
2	What do you understand by the term level crossing?	Understand	6,7
3	Explain the necessity of cross drainage structure.	Understand	6,7
4	Explain various types of cross drainage works.	Understand	6,7
5	What is a cross drainage work?	Understand	6,7
6	How would you select suitable type of cross drainage work?	Remember	6,7
7	Explain super passage in detail with neat sketch.	Remember	6,7
8	What is an aqueduct? Explain with neat sketch.	Remember	6,7
9	Write short notes on siphon aqueduct.	Remember	6,7
10	Write short notes on canal siphon.	Remember	6,7

## LONG ANSWERS

S.No	Question	Blooms Taxonomy Level	Programme Outcome
1.	Explain the procedure for the design of trapezoidal notch fall.	Understand	7
2.	Define outlet. What are the essential requirements of a good outlet?	Remember	7
3.	How would you select suitable type of cross drainage work?	Remember	7
4.	Explain super passage in detail with neat sketch.	Remember	7
5.	What is an aqueduct? Explain with neat sketch.	Remember	7
6.	Write short notes on siphon aqueduct.	Remember	7
7.	Write short notes on canal siphon.	Remember	7
8.	Explain the necessity of a cross-drainage structure how do you classify cross-drainage works.	Understand	7
9.	What points will you consider while selecting the site of a cross-drainage work?	Understand	7
10.	List out various functions of a distributory head regulator.	Understand	7

## XI. OBJECTIVE QUESTIONS: JNTUH

### UNIT I

- \_\_\_ shall not be permitted at any point of the dam
- The reservoir which balances the flow rates of supply and demand is \_\_\_\_\_.
- The gestation period of a major irrigation project is generally more than \_\_\_\_\_ years
- Selection of site for a dam ]  
 A) With clay foundation    B) Wide width of river  
 C) Suitable site for spill way    D) All the above
- The maximum pressure on the foundation soil due to the dam construction shall be less than  
 A) Ultimate bearing capacity    B) Safe bearing capacity  
 C) Allow able bearing capacity    D) All the above

### UNIT II

- If the height of a dam is less than or equal to limiting height of elementary profile, the dam is called \_\_\_\_\_.
- For a narrow V shaped valley with sound rock in abutment \_\_\_\_\_ is the best choice.  
 A) Gravity dam    B) Spillway    C) Cantilever dam    D) Arch dam
- The reservoir capacity for a given demand is obtained from  
 A) Double mass curve    B) Mass inflow curve    C) Hydrograph    D) None
- The following is not a component part of a diversion headwork  
 A) Spillway    B) Weir    C) Fish ladder    D) None
- A dam which resist the external forces acting on it by its self-weight  
 A) Weir    B) Spillway    C) Gravity dam    D) None

### UNIT III

1. The earthen dam provided with a stone masonry or concrete spillway section is known as \_\_\_\_\_.
2. The straight length of water expense measured normal to the axis of the dam is known as  
A) Silt pressure      B) Elementary profile      C) Headway      D) Fetch ]
3. It is an embankment protected on all sides by stones or concrete blocks.      A)  
Weir      B) Spillway      C) Groyne      D) none
4. The silt supporting power of a river or channel mainly depends upon      A)  
Silt pressure      B) hydraulic slope      C) headway      D) Fetch
5. Structure constructed to regulate the discharge, full supply level or velocity in a canal is known as  
A) Regulation work      B) Dam      C) CD work      D) none
6. \_\_\_\_\_ is an irrigation structure constructed across a canal to lower down its water level and destroy the surplus energy.

### UNIT IV

1. Due to the seepage beneath the dam, \_\_\_\_\_ is exerted on the underside of the dam
2. \_\_\_\_\_ failure is caused in weir due to suction caused by hydraulic jump.
3. As per IS code, the free board shall be more than \_\_\_\_\_ the height of wave  
A) 1.5 times      B) 1.8 times      C) 2.0 times      D) 2.2 times
4. An outlet is said to be proportional when flexibility is  
A) Less than one      B) Greater than one      C) Equal to one      D) none ]
5. Any hydraulic structure which supplies water to the off taking canal is called  
A) Headwork      B) Dam      C) Canal      D) none
6. Weirs classified as gravity and non gravity weirs based on the criterion of the design of  
A) Wall      B) apron      C) floor      D) none

### UNIT V

1. \_\_\_\_\_ is constructed where water surface level of drain at high flood is higher than the canal bed.
2. Works constructed across the river to raise water level and to divert into the canal are called \_\_\_\_\_.
3. \_\_\_\_\_ is provided in a canal head regulator to prevent spilling of water over the gates into the canal during high floods.
4. These are temporary structures permeable in nature provided on the curve of a river  
A) Guide bund      B) Spur      C) Groynes      D) All the above ]
5. The cross drainage work in which drainage is carried over the canal is called  
A) Super passage      B) Aqueduct      C) Both      D) None

### XII. GATE QUESTIONS:

1. The theory of infiltration capacity was given by  
(A) Merrill Bernard (B) W.W. Horner (C) Le-Roy K. Sherman (D) Robert E. Horton.
2. A recording type rain gauge  
(A) records the cumulative rain (B) produces a mass curve of rain fall (C) is sometimes called integrating rain gauge or continuous rain gauge (D) all
3. Absolute humidity in air  
(A) decreases at higher altitudes (B) increases at higher altitudes  
(C) remains constant at all altitudes (D) none of these.

4. If the potential infiltration of a water shed having a soil with fair pasture cover, is 10 cm and rainfall is 12 cm, the direct run off is  
(A) 2 cm (B) 5cm (C) 3cm (D) 8cm
5. For the estimate of high floods in fan-shaped catchment, the formula used is  
(A) Dicken's formula (B) Inglis formula (C) Ryve's formula (D) none of these.
6. If the viscosity of ground water is 1.00, the Slitcher's constant is 400, the effective size of soil particles in aquifer is 0.5 mm and hydraulic gradient is 1 in 80, the velocity of flow is  
(A) 0.50 m/day (B) 0.75 m/day (C) 1.00 m/day (D) 1.25 m/day.

**ii. IES**

1. Which of the following statements are correct?  
 A A fine sprinkle of precipitation of small and rather uniform water drops with all drop diameters below 0.10 mm is called as drizzle.  
 b The precipitation of liquid water with every drop diameter less than 0.5 mm is known as rain  
 c Precipitation in the form of balls or irregular lumps of ice each over 5 mm in diameter is called hail.  
 d Dew is formed directly by condensation on the ground mainly during night when the surface has been cooled by outgoing radiation  
 (a) 1 and 2 (b) 2 and 3 (c) 3 and 4 (d) 1 and 4
2. The double mass curve technique is used:  
 (a) To find the average rainfall over a number of years (b) To estimate the missing rainfall data  
 (c) To check the consistency of rain gauge records  
 (d) To find the minimum number of rain gauges required in a basin
3. Steep rise in the flow-mass curve during a certain period indicates:  
 (a) Very high evaporation losses during that period (b) Flash floods during that period  
 (c) Sudden spurt in irrigation demand during that period  
 (d) Sudden rise in demand for water to meet hydropower generation.
4. Wading technique is used:  
 (a) To determine velocity of sea waves during Tsunami  
 (b) To determine thickness of canal lining in alluvial soils  
 (c) To measure the volume of dredging material in harbours  
 (d) To determine velocity of flow in shallow streams

**XIII. WEBSITES:**

1. [www.indianetzone.com/24/water\\_resources](http://www.indianetzone.com/24/water_resources)
2. [www.wrmin.nic.in](http://www.wrmin.nic.in)
3. [indiahousing.com/water-resources-india.html](http://indiahousing.com/water-resources-india.html)

**XIV. EXPERT DETAILS:**

1. Dr.P.G.Sastry
2. B.P.Venkateshwarlu
3. P Rama Raju
4. DeepakKhare

**XV. JOURNALS:**

1. Journal of Water Resources and Hydraulic Engineering
2. Journal of Water Resources Planning and Management
3. Water Resources and Hydraulic journals
4. International journal of Water Resources

**XVI. LIST OF TOPICS FOR STUDENT SEMINARS:**

1. Reservoir sedimentation
2. Foundation for a Gravity dam.
3. Causes of failure of earth dam
4. USBR and Indian types of stilling basins.

**XVII. CASE STUDIES / SMALL PROJECTS:**

1. Life of Reservoir
2. Stability analysis of a Gravity dam.
3. Spillway gates.
4. Design principles of Notch Fall.