Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-6 (B. Tech.)

Subject: Hydraulics Structure – BETCV16331
Type of Course: Professional Elective
Prerequisite: Knowledge of Fluid mechanics & Irrigation Engineering

Rationale: Design of Hydraulic structures forms an integral part of water resources engineering projects. It includes selection of site for a particular type of dam, design and constructional features of Gravity dam, Embankment dams, and Rock fill dams. A hydraulic engineering has to develop understanding of principles of design of earth dam, gravity dam, spillways and energy dissipation devices.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					
				Theory Marks		Practical Marks		CA	Total Marks
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	**Dams and Foundation Treatment:** Classification of Dams, Investigations for Dam Sites, Selection of site for Dams, Selection of Type of Dam, Merits and demerits of all types of dams, Importance of Subsurface Exploration, Foundation Treatment Methods, Materials and Techniques.	05	15
2	**Gravity Dams** Definition, Forces acting on the Dam, Combinations of load on the Dam, Causes of failure of Dams, Design criteria for Gravity Dams, Principal and Shear stresses, Elementary and Practical Profile of a Gravity Dam, High and Low Dam, Stability Analysis of a Gravity Dam, Design of Gravity Dams, Control of Temperature in Dams, Construction of dam, and joints in Dams, Galleries in Dams.	10	20
3	**Earth and Rock-fill Dams** Introduction, Earth Dam Definitions, Classification of Non – Rigid Dams, Causes of failure of Earth dams, Design Principles of Earth Dams, Profile of an Earth Dam, Side slopes and Protection Measures for Earth Dams, Core and Casing for Earth Dams, Construction Materials for Earth Dams, Cut off and Seepage Control Measures in Earth Dams, Drainage system for Earth Dams, Typical Sections of Earth Dams, Selection of Dam section, Construction of Earth Dams, , Stability of Slopes, Stability of Foundation against Shear, Design considerations in Earthquake Regions	15	30
4	**Spillways, Sluices and Crest Gates** Definition and Types of Spillways, Components of Spillway, Chute Spillway, Side Channel Spillway, Shaft Spillway, Siphon Spillway, Design of Ogee Spillway, Profile of Ogee Spillway, Cavitation Erosion of Spillway Surface, Design of Chute spillway, Aeration Galleries, Spillway crest Gates, Sluices in dam	10	20
5	**Energy Dissipators** Energy Dissipation below Overflow Spillways, Energy Dissipation by Hydraulic Jump, Location of hydraulic jump, Design criteria for Stilling Basins and their design, IS Standardized Basins, Various methods of Energy Dissipation and their design.	05	15

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Field Visits on Hydraulic Structure** Organize industrial visits by faculty to nearby Hydraulic structure. Students observe structural components (spillways, sluice gates, stilling basins). Take notes, photos, and ask engineers questions. Submit a reflection report with diagrams in GMIU Web Portal.	10

2	**Case Study Analysis of real hydraulic structures** Assign case studies of real hydraulic structures (dams, barrages, weirs, spillways, cross-drainage works). Students are divided into groups. Each group studies one structure, its purpose, design considerations, and challenges. Present findings in class (poster, PPT, or report) and submit the report in GMIU Web Portal.	10
3	**Mini-Projects on working condition- hydraulic structures** Create mini project on Hydraulic jump study in a flume or Rainwater harvesting structure design or Cross-drainage work design. Students' complete projects over 3 - 4 students' groups. This report, drawings, and presentation submit the GMIU Web Portal.	10
TOTAL		30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	15%	20%	25%	20%	10%	10%

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.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand suitable type of Dam and its sites for construction.
CO2	Calculate forces, stresses on gravity dam and check various factor of safety.
CO3	Locate phreatic line and carryout seepage and stability analysis of Embankment dam under various hydraulic conditions.
CO4	Explain and Design Ogee and Chute spillway
CO5	Explain and Design energy dissipation devices.

List of Practical

Sr. No.	Descriptions	Unit No.	Hrs.
01	Determination of permeability of soil samples for foundation treatment using constant head Test.	01	04
02	Determination of permeability of soil samples for foundation treatment using falling head test.	01	04
03	Study of foundation treatment methods using grout materials.	01	02
04	Stability analysis of a gravity dam by calculating overturning, sliding, and shear resistance using a model profile.	02	04

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05	Preparation of elementary of a gravity dam and plotting principal stresses.	02	02
06	Preparation of practical profile of a gravity dam and plotting principal stresses.	02	02
07	Determination of phreatic line in an earth dam model using sand tank experiment.	03	02
08	Design and plotting of ogee spillway profile for given head of water.	04	02
09	Hydraulic model study of flow over a spillway with crest gates.	04	04
10	Experimental study of hydraulic jump in a rectangular flume and determination of energy loss and jump location.	05	04
TOTAL			**30**

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses. Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Irrigation Engineering and Hydraulic Structures by S K Garg
[2] Irrigation and Water Power Engineering by Dr. B.C.Punamia,
[3] Irrigation and Water Resources Engineering by G L Asawa
[4] Theory and Design of Hydraulic Structures Vol. 1 and 2 by R.S.Varshney, S.C. Gupta, R.L. Gupta
[5] Irrigation and Hydraulic Structures: Theory, Design and Practice by Iqbal Ali
[6] Hydraulic Engineering of Dams by Willi H. Hager, Robert M. Boes, Michael Pfister, Anton J. Schleiss