

# GUJARAT TECHNOLOGICAL UNIVERSITY

## CIVIL (GEOTECHNICAL ENGINEERING) (43)

### EARTH AND ROCKFILL DAMS

**SUBJECT CODE:** 2734303

M.E. 3<sup>rd</sup> SEMESTER

**Type of course:** Core

**Prerequisite:** Geotechnical Engineering/Foundation Engineering and Fluid Mechanics and Rock Mechanics

**Rationale:** Earth and Rockfill dam is an specialized subject dealing with construction, execution and maintenance of earth and rock fill dams meant for various purposes. Selection of proper topography and proper site investigation are basic requirements of dam design. Design of earthen dams and its various components as per codal guidelines and various stability calculations for end conditions are some of the important aspects of this subject. Its proper selection will ultimately lead to its full utility and proper stability against various forces. The course on *Earth and Rockfill Dams* provides the students basic knowledge on dam selection, dam design , dam stability checks, instrumentation and maintenance of dams for proper functioning and utility acquainted with latest field practices and codal guidelines. This will help them to analyze, design and execute suitable type of earth and rockfill dam for various purposes for which it is needed and to carry out systematic maintenance operation throughout its service period.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

#### Content:

Sr. No	Content	Total Hrs	% Weightage
1	<b>Site investigation:</b> Classification of dam w.r.t material, construction technique, purpose, etc; selection of basic dam section and factors affecting it, classification and selection of construction materials and construction technique. special problems pertains to foundation treatment and related case studies.	06	15
2	<b>Earthen dams</b> Design of earth dam (small and large) as per general practice and codal guidelines, stability analysis for various conditions, design of filters for slope protections, relief well and upstream blanket, quality control, failure of dams.	09	35
3	<b>Rockfill dams</b> Selection of materials, design details and modern construction techniques of rockfill dam, special problems, settlement, core and transition zone, limitations of laboratory parameters evaluations, rockfill and spillway operation, routing of floods, gate operation.		25
4	<b>Quality control measures</b> Need of instrumentation, classification of instrumentation, location of in dam section, monitoring of dam, maintenance and dam safety measures, distress and remedial measures in earth and rockfill dams, earth pressure problems at	07	20

**Reference Books:**

1. L. Earth and Rockfill Dam, Wiley, 1967.
2. Creager W. P. Engineering for dams, Wiley, 1967.
3. Singh, B. Earth and Rockfill dam, Sarita Prakashan, 1973.
4. Sowers G. I. Earth and Rockfill dam engineering, A. Earth Manual, USBR Publication.
5. Arcold - Volume on earth and rockfill dams.
6. Mistry J. F., Dams and Appurtenant Works (Imp. Aspects of River valley projects),  
1. Mahajan Book Dist., 1998.
7. Sharma H. D., Embankment Dams, Oxford and IBH Pub., 1991.
8. Design of Small Dams, USDI, Oxford and IBH, 1976

**Course Outcome:**

After learning the course the students should be able to:

1. Selection of dam site as per purpose and availability of construction material.
2. Design earthen dams and rockfill dams and various components including design of filters, riprap, relief wells as per codal guidelines and analyse stability of dams for various hydraulic conditions.
3. Estimate seepage and to identify most reliable seepage control measures for both earthen and rockfill dams. Establish proper foundation treatment as per field requirement and identify source of treatment.
4. Selection of proper construction techniques for rockfill dams, mitigation of settlement problems, design of membranes/blankets for slope protection, core design and selection of geometry and gate operation during flood times and routine maintenance.
5. Selection and implementation of proper instrumentation at various locations and continuous monitoring of dams including dam safety measures as per codal guidelines.
6. Understand a role of geotechnical engineer as dam engineer/ earthen dam specialist and its implication for proper execution of any project.

**List of Experiments:**

Design of earthen dam and rockfill dam including stability checks as per codal guidelines supported by at least two case studies. Design of cut-off walls, filters, relief wells, membranes for various types of earthen and rockfill dams of various sections based on codal provisions. Maximum no of problems may be equal to 15-20.

**Design based Problems (DP)/Open Ended Problem:**

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below:

1. Development of spread sheets/computer programmes for the calculations of stability of dams for various end conditions for various dam sections or by using software's like PLAXIS, SLOPE, SLIDE, GEOSTUDIO.
2. Collection of data of various earthen dams of Gujarat from government irrigation departments and to carry post stability analysis based on seismicity and to suggest remedial measures for various types of damages.

**List of Open Source Software/learning website:**

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

<http://ocw.mit.edu/courses/civil-and-environmental-engineering/>

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.