

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: ADVANCED CONSTRUCTION TECHNOLOGY

(COURSE CODE: 3350605)

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering	5 th Semester

1. RATIONALE

As a prerequisite to this course, it is expected that students have already learnt some basic concepts, principles and important aspects of construction technology in the third semester course (Code: 3330602). Now in this course of 'Advance Construction Technology', some advance aspects of construction technology will be covered. In today's times the construction activities is undergoing lots of changes/developments due to internal and globalised market demands of quality and faster completion of project works using modern techniques, use of modern and waste materials, and through mechanized construction. Today, we require high capacity machines with better output and greater efficiency to make construction process less stressful. This course has been designed so that diploma engineers would be able to use advanced construction technology

2. LIST OF COMPETENCY

The course content should be taught and learning imparted with the aim to develop in students' construction technology related advanced knowledge and skills so that they are able to:

- **Use advanced construction technologies**

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 outcomes in cognitive, psychomotor and affective domain to demonstrate following course learning outcomes:

Select appropriate equipment/machines for different construction activities with right choices of techniques for a given application.

- i. Report the important operations of construction activities they visited where new techniques, machines and equipment are used.
- ii. Describe important aspects, operations and safety points pertaining to:
 - a. 'Deep Excavations';
 - b. Pile foundations ;
 - c. Cofferdams;
 - d. Caissons;
 - e. Drilling and Blasting
- iii. Discuss purpose, types, materials, design issues, and erection of temporary structures for construction activities.

- iv. Describe equipment and tackles used , problems encountered and their solutions in erection of steel structures

4. TEACHING AND EXAMINATION SCHEME

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

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

Note: It is the responsibility of the institute heads that marks for **PA of theory, ESE and PA of practical** for each student are entered online into the GTU portal at the end of each semester within the dates specified by GTU.

5. COURSE DETAILS

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Modern Materials and Equipment used in Special Constructi ons	1a. describe the features of special types of civil engineering structures 1b. discuss properties of advance materials and byproducts such as fly ash, red mud, furnace slag and their suitability to civil works.	1.1 Features and functions of the special types of civil engineering structures: Multistoried building, Chimney, Elevated service reservoir, Dams and retaining walls, Bridges and hydraulic structures, Industrial structures, Marine and offshore structures, Tall structures. 1.2 Effect of lateral forces on building like Wind, Water and Earthquake 1.3 Admixtures and its Classification 1.4 Use of Waste products and Industrial Byproducts in bricks, blocks, concrete and mortar.
	1c. Discuss main features of hauling equipment and hoisting equipment. 1d. State the factors affecting the selection of of hauling equipment and hoisting equipment.	1.5 Hauling equipment: Trucks, Wagon, Dumpers, Scrapers and rippers. 1.6 Hoisting equipment: Derrick-Pole, Gin Pole, Crane, Power driven scotch derrick crane, Hand operated crane, Locomotive crane, Gentry crane, Tower crane, Lattice Girder, Winches, Elevators, ladders.

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	1e. Discuss main features of hauling equipment and hoisting equipment. 1f. State the factors affecting the selection of hauling equipment and hoisting equipment.	1.1 Conveying equipment: Belt conveyors, Buckets, Chutes 1.2 Pumping equipment: Water pumps and concrete pumps.
	1g. Discuss main features of compacting and pile driving equipment. 1h. State the factors affecting the selection of compacting and pile driving equipment.	1.9 Compacting equipment: Rollers (earth compaction), Smooth surface roller, sheep foot roller, pneumatic rollers, tamping roller, vibrating roller and compactors. 1.10 Pile Driving Equipment including types of hammer driving, drilling equipment with types of drill.
	1i. Discuss main features of vibrators and crushers. 1j. State the factors affecting the selection of vibrators and crushers.	1.11 Vibrators: for concrete consolidation: Internal, Needle, Surface, Platform and form vibrators. 1.12 Crushers and other Equipment: used for Production of aggregate Jaw crusher, Gyratory crusher, Roll crusher, Cone crusher, Rod and ball mill, screens, Log washer.
	1k. Discuss main features of bituminous road construction and dredging equipment. 1l. State the factors affecting the selection of bituminous road construction and dredging equipment	1.13 Bituminous road construction Equipment 1.14 Equipment for large concrete works 1.15 Dredging equipment
Unit- II Excavation and related Equipment	2a. Differentiate between shallow and deep excavation with examples/sketches. 2b. Explain timbering operation in trenches. 2c. Explain the dewatering procedure	2.1 Shallow and deep excavation. 2.2 Dewatering situations, necessity and method of dewatering. 2.3 Dewatering
	2d. Discuss main features of excavation machinery and earth moving vehicles. 2e. State the factors affecting the selection of excavation	2.4 Excavations Machinery: Power Shovel, Drag line, Calm Shell, Scoop, Trenching equipment, Wheel mounted belt loaders.

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	machinery and earth moving vehicles 2f. Discuss main features of earth moving machinery.	2.5 Earth moving Vehicles: Tractors, Boulders, Graders, Scrapers, Rippers.
	2g. State the factors affecting the selection of Earth moving machinery.	2.6 Earth moving machinery: Handling, Hoisting, Conveying, Pumping, and Compacting, Pile driving, Drilling equipment, Plants for Grouting, Guniting and Hot Mix Plant, Concrete Mix Plant, Ready Mix Plant
Unit– III Pile Foundation	3a. Classify pile foundations. 3b. Explain the factors affecting the selection of types of piles. 3c. Justify the use of pile foundation for a given situation. 3d. Describe the features of the equipment, tools and method of construction of under reamed piles. 3e. Describe pile driving method. 3f. Discuss efficiency of group of piles.	3.1 Pile foundations, Classification. 3.2 Sheet piles based on materials. 3.3 Classifications of piles based on materials like concrete, steel, timber, composite, sand, concrete (pre-cast, Cast –in – situ, Pre-stressed) including cased and uncased with advantages and disadvantages. 3.4 Selection of type of piles. 3.5 Pile accessories and tools. 3.6 Pile driving methods. 3.7 Failure or settlement of piles. 3.8 Under reamed piles including method of it' construction. 3.9 Group action of piles and its efficiency.
Unit-IV Coffer Dams and Caissons	4a. Explain purpose, use and principles of working of coffer dams. 4b. Describe the major features of types of coffer dams with sketches. 4c. State the selection criteria of types of coffer dams 4d. State the leakage points and suggest leakage prevention in coffer dams.	4.10 Coffer dams: Types, requirements, Selection criteria, Design features, Leakage points and leakage prevention in coffer dams.
	4e. Differentiate between Coffer dams and caissons 4f. Describe the uses of caissons.	4.11 Caissons: Materials used, Sinking loading of caissons

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	4g. Classify the types of caisson. 4h. Explain method of sinking of caissons. 4i. State the problems and suggest suitable solutions in well sinking	
Unit-V Drilling and Blasting	5a. Classify various types of Drilling and their suitability. 5b. Describe drilling operations 5c. Justify with example the necessity of drilling at construction site.	5.1 Drilling: Types, Drilling requirements, 5.2 Selecting the drilling pattern for blasting 5.3 Effect of air pressure on drilling operation 5.4 Betonies/mud slurry in drilling 5.5 Factors affecting the selection of drilling method and equipment
	5d. Describe the step-by-step blasting process of using explosives with safety precautions. 5e. Explain the precautions required in blasting and drilling operations, in storage and in handling of explosives	Blasting 5.6 Explosives for blasting: Dynamite, Blasting caps Prime line, Safety fuse, Stemming, Blast hole, Prime detonators 5.7 Process of using explosive 5.8 Types of blasting, Precautions 5.9 Storage of explosives 5.10 Features of magazine building
Unit-VI Erection of Steel Structures	6a. Describe various types of formworks with its advantages 6b. Discuss the principles of using slip formwork 6c. Describe cantilever method of Pre-stressed concrete bridge Construction 6d. Sketch the formwork for columns, beams and slabs and others for given problem situation with labels	6.1 Formwork: Requirements of a good form work, Loads, guiding points for design 6.2 Column form work 6.3 Slab and beam formwork 6.4 Slip form work 6.5 Hanging form works and Trestles 6.6 Form work for domes and arches. 6.7 Cantilever method of Pre-stressed concrete bridge construction
	6e. Describe problems faced and solutions adopted in erection of various types of steel structures such as roof truss, bridge girders. 6f. Discuss various types of equipment and tackles used in 6g. erection of various types of steel structure	6.8 Roof truss: erection problems Building / Industrial component, Equipment and tackles used for erecting these 6.9 Plate girder Launching a portion of bridge Girder, Large span lattice girder 6.10 Erection of chimney

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
		Erection of overhead tank.

6.0 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Modern Materials and Equipment for Special Constructions	10	08	06	05	19
II	Deep Excavation	04	03	02	02	07
III	Pile Foundations	08	06	04	02	12
IV	Coffer Dams and Caissons	08	06	04	04	14
V	Drilling and Blasting	04	03	02	01	06
VI	Erection of steel structures	08	06	04	02	12
	Total	42	32	22	16	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.

7.0 SUGGESTED LIST OF EXERCISES/PRACTICALS

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

*Note: Here performance outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed and demonstrated appropriately, they would contribute to the development of demonstrated learning in behavioral terms in affective domain. As a whole, the total approach towards acquisition of knowledge, skills, abilities and behavior and demonstration of the same would lead to the development of **Course Outcomes**. 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 Exercises (outcomes in Psychomotor Domain)	Approx Hours Required
		Part-A (Sketches With Nomenclature and Short Details-Study and Information Based in Sketch book)	08 hrs
1	II	Plants And Equipment Used In Construction a. Earthmoving machineries b. Equipment for excavation c. Handling equipment d. Hoisting equipment e. Conveying equipment f. Pumping equipment g. Compacting equipment h. Concrete vibrating equipment i. Pile driving equipment j. Plants for Grouting, Guniting. k. Drilling equipment l. Concrete and mixing plant	
	III	Various types of timbering.	
	III	Dewatering methods.	
	III	Different types of shallow and deep foundations.	
	IV	Different types of pile foundations.	
	V	Different types of coffer dams.	
	VI	Different types of caisson.	
	VI	Slip form work	
	V	Blast hole	
	VI	Slab and beam formwork	
	VI	Column formwork	
		PART-B (Site Visit And Preparation Of Detailed Report Recording Main Operations (May Be With Photos) As Observed And Discussed With Site Officers, Of Atleast One Visit)	08 hrs
2	II	Prepare a site visit report regarding your visit in which construction work is going on with advanced equipment's stating list of equipment including its selection criteria and its advantages.	
	III/IV	Prepare a site visit report regarding your visit in which deep foundation work is going on including type of deep foundation selection criteria.	
	V	Prepare a site visit report regarding your visit in which cassion / cofferdam construction work is going on.	
	VI	Prepare a site visit report regarding your visit in which	

S. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Approx Hours. Required
		drilling/ blasting work is going on.	
	VI	Prepare a site visit report regarding your visit in which erection of steel structure work is going on.	
		Part-C (Seminar Presentation)	06 hrs
3	I to VI	Topic of Seminar shall be given to a group of students. The students are required to submit and present / defend the Seminar in presence of students and teachers and report including PowerPoint presentation to be attached with submission. Each individual student's contribution in group work need to be made explicit.	
		Part-D –Prepare A Case Study (Any One)	06 hrs
4	I to VI	Based on advanced construction technology curriculum, on any one related topic narrating the case with specific operations/ problems faced/resolved from nearby construction work area with short details.	
Total Hours			28 rs

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Prepare experimental journals based on practical performed in laboratory.
- ii. Assignments on solving field problems of construction or numerical problems
- iii. Prepare chart displaying various types of pile foundation, coffer dams, caissons, etc.
- iv. Prepare the schematic diagram for various types of plants.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- (i) Arrange visit to nearby following sites and write visit report
 - (a) For a High Rise Building, Docks, Jetties, Pile driving sites, etc. those who are using all kind of advanced equipment.
 - (b) For a Hot Mix Plants, Concrete Mix Plants, RMC, Aggregate Crusher site, etc.

10 SUGGESTED LEARNING RESOURCES

A) List of Books

Sr. No.	Title of Book	Author	Publication
1.	Building construction	S.P. Arora and S.P. Bindra	Dhanpat Rai
2.	Building Construction Engineering	Gurcharansingh	Jain Book Agency
3.	Construction, planning	Robert L. Peurifoy	Mc Graw Hill India

Sr. No.	Title of Book	Author	Publication
	equipment and methods		
4.	Building Construction	Sushil Kumar	Standard Publishers
5.	Learning from failures	R.N. Raikar	Structural Designers and Consultants, New Delhi
6.	Durable structure through planning for preventive measures	R.N. Raikar	Structural Designers and Consultants, New Delhi
7.	Diagnosis and Treatment structure in Distress	R.N. Raikar	Structural Designers and Consultants, New Delhi
8.	Building structures	James Abrose.	Wiley Publishers
9.	Standard handbook of civil engineering	Gurcharansingh	S P P
10.	Building construction	B.C. Punmia	Laxmi Publication, New Delhi
11.	Building construction	S.C. Rangwala	Charotar Publishing House Pvt. Ltd. Anand
12.	Civil Engineering Practice (I,II,III)	Kaushik, Asawa and Ahuja	Publishing House, New Delhi
13.	Civil Engineering Construction	Antill and Ryan	Angus and Robertson
14.	Pile Foundations	Tomlinson	Longman Group, U. K.
15.	Relevant IS codes	-	BIS, New Delhi

B) List of Major Equipment/ Instrument with Broad Specifications: (Teachers are requested to provide here a sample list)

C) List of Software/Learning Websites

- i. www.sskphdmm.com
- ii. www.nptel.iitm.ac.in

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. P. D. Gohil**, Sr. Lecturer in Civil Engineering, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.
- **Prof A. K. Popat** Sr. Lecturer in Civil Engineering , Government Polytechnic, Dahod
- **Prof. D. V. Jariwala** Sr. Lecturer in Civil Engineering , Government Polytechnic, Bharuch
- **Prof. H.K.Rana** Sr. Lecturer in Civil Engineering , Government Polytechnic, Valsad

Coordinator and Faculty Member from NITTTR Bhopal

- Dr. V H Radhakrishnan, Professor, Department of Civil and Environmental Engineering