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	5th Semester

1. RATIONALE

As students have learnt the in Building Materials and Construction Technology basic properties and behavior of materials, Testing of them and construction techniques and methods by using and applying the traditional as well as new scientific approach for the different type of constructions and building. To develop the more essential technology and construction approach they are able to develop the some of skills and techniques of field construction, maintenance and repairs to construction. Now students are able to supervise and carry out the construction activity to quality expectations. In Advanced Construction Technology, the students are able to learn the working and efficiency of advance construction equipment's, handling of equipments, proper judgment of right choices of equipments and construction techniques.

Advanced construction technology is the basic requirement for preparing any kind of engineering construction project in an isolated construction sites and it can be done only when various steps involved in the construction work are known. To achieve these skills operation and handling of various advanced construction sites like High Rise Tower, ESR, Docks and Jetties, Bridges, Highways, Dams, Mega Structures, Buildings, Irrigation, Water supply and drainage, constructions for Disposal of Wastes, construction in a water logged areas, etc. should be known. In this course such desired performing abilities will be developed which are expected from a civil engineering technician.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies:

1. To know and understands the new approaches of construction or alternate approach of construction for next generations and for our ecology system of our construction industries**.**

2. To select the suitable construction equipments for best execution of various construction activities by using advanced equipments and new scientific approach.

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 outcomes.

i. The students will be able to handle the big construction sites by using equipments.
ii. The students will synchronize the construction activity with new techniques and equipments.
iii. The students will be able to select the suitable equipments for proper construction activities with right choices of techniques for a given application.
iv. The students will be able become a link to the new construction for the years to go by using Synchronous machines for power factor improvement.

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	
3	0	2	5	70	30	20	30	150

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

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I. Introduction and Modern Materials of Construction	1a. Understand the advance types of civil engineering structures 1b. Identify and understand the properties of advance materials and byproducts like fly ash, red mud, furnace slag, etc.	1.1 State the advanced types of civil engineering structures like Multistoried building, Chimney, Elevated service reservoir, Dams and retaining walls, Bridges and hydraulic structures, Industrial structures, Marine and offshore structures, Tall structures. 1.2 Introduction to the effect of lateral forces on building like Wind, Water and Earthquake 1.3 Admixtures with its purposes 1.4 Classification of admixtures 1.5 Use of Waste products and Industrial Byproducts in Concrete.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit– II **Plants and Equipment used in Construction**	2a. State the all advanced plants and equipments used in construction. 2b. Differentiate between the Earth moving and Hauling equipments. 2c. 2c. Explain with sketch all advanced plants and equipments used in construction.	2.1 Earth moving machineries, Handling, Hoisting, Conveying, Pumping, and Compacting, Pile driving, Drilling equipments, Plants for Grouting, Guniting and Hot Mix Plant, Concrete Mix Plant, Ready Mix Plant, etc. 2.2 List factors affecting the selection of equipments depending on the various parameters. 2.3 Equipments for excavation like Power Shovel, Drag line, Calm Shell, Scoop, Trenching equipments, Wheel mounted belt loaders. 2.4 Equipments for Earth moving equipments like Tractors, Boulders, Graders, Scrapers, Rippers, etc. 2.5 Equipments for hauling equipments like Trucks, Wagon, Dumpers, Scrapers and rippers. 2.6 Equipments for Hoisting equipments like Derrick-Pole, Gin Pole, Crane, Power driven scotch derrick crane, Hand operated crane, Locomotive crane, Gentry crane, Tower crane, Lattice Girder, Winches, Elevators, ladders. 2.7 Conveying equipments like Belt conveyors, Buckets, Chutes 2.8 Pumping equipments like Water pumps and concrete pumps. 2.9 Compacting equipments like Rollers (earth compaction), Smooth surface roller, sheep foot roller, pneumatic rollers, tamping roller, vibrating roller and compactors, etc. 2.10 Equipments for Pile driving including types of hammer driving, drilling equipments with types of drill.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		2.11 Vibrators for concrete consolidation like Internal, Surface, Platform and form vibrators. 2.12 Equipments used for Production of aggregate Jaw crusher, Gyratory crusher, Roll crusher, Cone crusher, Rod and ball mill, screens, Log washer. 2.13 Equipment and Machineries used for Bituminous roads 2.14 Equipment and Machineries used for Large concrete works 2.15 Dredging equipments
Unit– III Deep Excavation	3a. Explain the shallow and deep excavation 3b. Differentiate shallow and deep excavation. 3c. Explain timbering in trenches. 3d. Explain the dewatering.	3.1 Explain the shallow and deep excavation. 3.2 Differentiate between the shallow and deep excavation. 3.3 Importance or necessity of timbering. 3.4 Understand the members used in timbering. 3.5 Explain the timbering in trenches. 3.6 List and explain each precautions to be taken during timbering. 3.7 Explain the dewatering including necessity and situations of dewatering. 3.8 Explain in detail the dewatering methods with necessary sketch. 3.9 List the suitability of different methods of dewatering.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit–IV Pile Foundations	4a. Classify of pile foundations. 4b. List the factors affecting the selection of types of piles. 4c. Indentify the efficiency of group of piles.	4.1 List the situations demanding the use of pile foundations. 4.2 Classification of piles based on their function or use. 4.3 Explain the sheet piles based on materials. 4.4 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. 4.5 List and explain the factors affecting the selection of type of piles. 4.6 Explain the pile accessories. 4.7 List and explain the pile driving methods. 4.8 Causes of failure or settlement of piles. 4.9 Explain the under reamed piles including construction of it. 4.10 Explain the group action of Piles with its efficiency.
Unit-V Coffer Dams	5a. Describe the requirements of a coffer dam. 5b. Describe the selection of types of coffer dams. 5c. Identify the leakage prevention in coffer dams.	5.1 Define the coffer dam and write the requirements of a coffer dams. 5.2 State the necessity of coffer dams. 5.3 State the uses of coffer dams. 5.4 List the selection criteria for a coffer dams. 5.5 List and explain the types of coffer dams with neat sketches including construction where ever necessary. 5.6 Write the design features of coffer dams. 5.7 State the leakage prevention in coffer dams. 5.8 Write the short note on economic height of coffer dams.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-VI Caissons	6a. Describe the uses of caissons. 6b. Classify the types of caisson. 6c. understand the problems in well sinking.	6.1 Define and short note of the caissons. 6.2 Understand and state the uses of caissons. 6.3 Differentiate the caissons and coffer dams. 6.4 List and describe the materials used for caissons. 6.5 State and explain all the types of caissons with neat sketch. 6.6 Explain the loads on caissons. 6.7 Explain the Sinking of caissons. 6.8 State and explain the problems in well Sinking including neat sketches.
Unit-VII DRILLING AND BLASTING	7 a Describe drilling operations 7 b Classify various types of Drilling 7 c Understand necessity of drilling 7d Describe blasting process 7e Understand explosive process 7 e Enlist the ggeneral precautions required for blasting	7.1 Define drilling operation 7.1.1 Explain necessity of drilling 7.2 Terminology used for drilling 7.3 Factors affecting the selection of drilling method & equipment. 7.4 Types of drilling 7.5 Necessity of selecting the drilling pattern for blasting 7.5.1 Discuss the economy of drilling hole 7.5.2 Factors helping in analyzing the drilling operations 7.6 Effect of air pressure on drilling operation 7.7 Analyze factors affecting the optimum drilling pressure 7.8 Use of bentonite/mud slurry in drilling 7.9 Define blasting 7.10 Terminology used for blasting 7.10.1 Enlist the explosives 7.10.2 Define terms like - Dynamite, Blasting caps , Prime line ,Safety fuse ,Stemming ,Blast hole ,Primer, Prime det 7.11 Explain explosive process 7.12 Types of blasting 7.13 General precautions required for blasting 7.14 Necessity of storing explosives

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		properly 7.15 Give salient features of a magazine building 7.16 Effect of air pressure on drilling.
Unit-VIII TEMPORARY STRUCTURES	8a Describe various types of formworks with its advantages 8b Understand slip formwork 8c Describe cantilever method of Pre-stressed concrete bridge construction 8d Understand sketch of column , beam and slab formwork	8.1 Explain form work 8.1.1 Materials used in form work 8.1.2 State advantages of steel form work 8.1.3 Advantages of timber forms 8.1.4 Requirements of a good form work 8.1.5 Loads on form work 8.1.6 Guiding points to the design of form work 8.2 Column form work 8.3 Slab & beam formwork 8.4. Slip from work 8.5 Hanging form works and trestles 8.6 Form work for domes and arches. 8.7 Cantilever method of Pre-stressed concrete bridge construction
Unit-IX ERECTION OF STEEL STRUCTURES	9a Describe problems faced in erection of various types of steel structures 9b Enlist various types of equipments and tackles used in erection of various types of steel structures	9.1 Problems faced in erecting different steel structure like: Roof truss Building / Industrial component Plate girder Launching a portion of bridge girder Large span lattice girder. 9.2 Equipment & tackles used for erecting steel structure for Roof truss Building / Industrial component Plate girder Launching a portion of bridge girder Large span lattice girder. Erection of chimney Erection of overhead tank.

6.SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction and Modern Materials of Construction	02	02	02	03	07
II	Plants and Equipment used in Construction	08	06	04	02	12
III	Deep Excavation	04	03	02	02	07
IV	Pile Foundations	08	06	04	02	12
V	Coffer Dams	04	03	02	02	07
VI	Caissons	04	03	02	02	07
VII	Drilling & Blasting	04	03	02	01	06
VIII	Temporary structures	04	03	02	01	06
IX	Erection of steel structures	04	03	02	01	06
	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.

SUGGESTED LIST OF EXERCISES/PRACTICALS

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 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.

S. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Approx Hours. required
		PART-A (SKETCHES WITH NOMENCLATURE AND SHORT DETAILS-STUDYAND INFORMATION BASED IN SKETCHBOOK)	**08 hrs**
1	**II**	**PLANTS AND EQUIPMENT USED IN CONSTRUCTION** Earthmoving machineries Equipment for excavation Handling equipment Hoisting equipment Conveying equipment Pumping equipment Compacting equipment Concrete vibrating equipment Pile driving equipment Plants for Grouting, Guniting. Drilling equipment 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.	
	VIII	Slip form work	
	VII	Blast hole	
	VIII	Slab & beam formwork	
	VIII	Column formwork	
	VIII	Crib and Trestle	
		PART-B (SITE VISIT AND PREPARATION OF DETAILED REPORT 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 equipments 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/VI	Prepare a site visit report regarding your visit in which cassion / cofferdam construction work is going on.	
	VII	Prepare a site visit report regarding your visit in which drilling/ blasting work is going on.	

	VIII/IX	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 IX**	Topic of Seminar shall be given to a group of students. The students are required to submit & present / defend the Seminar in presence of students & teachers and report including PowerPoint presentation to be attached with submission.	
		PART-D CASE STUDY (ANY ONE)	**06 hrs**
4	**I TO IX**	Based on advanced construction technology curriculum related topic the advances occurred in nearby area or in the world knowing to them with short details.	
		Total Hours	**28 hrs**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

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

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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

9. SUGGESTED LEARNING RESOURCES

A) List of Books

Sr. No.	Title of Book	Author	Publication
1.	Building construction	S.P. ARORA & S.P. BINDRA	Dhanpat Rai
2.	Building Construction Engineering	GURCHARANSINGH	Jain Book Agency
3.	Construction, planning equipment & methods	ROBERT L. PEURIFOY	Mc Graw Hill India
4.	Building Construction	SUSHIL KUMAR	Standard Publishers
5.	Learning from failures	R.N. RAIKAR	R & D Centers Structwel Designers & Consultants, New Delhi
6.	Durable structure through planning for preventive	R.N. RAIKAR	R & D Centers Structwel Designers

	measures		& Consultants, New Delhi
7.	Diagnosis and Treatment structure in Distress	R.N. RAIKAR	R & D Centers Structwel Designers & 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
11.	Building construction	S.C. Rangwala	Charotar Publishing House Pvt. Ltd.
12.	Civil Engineering Practice (I,II,III)	Kaushik, Asawa & Ahuja	Publishing House, New Delhi
13.	Civil Engineering Construction	Antill & Ryan	Angus and Robertson
14.	Pile Foundations	Tomlinson	Longman Group , U. K.
15.	Relevant IS codes/Building		BIS, New Delhi

B) List of Major Equipment/ Instrument with Broad Specifications

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